THE EFFECTS OF EXPOSURE TIME IN IMMEDIATE RECALL ON ABNORMAL AND QUESTIONNAIRE CRITERIA OF PERSONALITY

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INTRODUCTION

THE present investigation deals with the effects of two lengths of exposure time in neurotic and schizophrenic subjects, and with the relations between these effects and measures of extraversion, neuroticism and rigidity. A consideration of previous work, discussed in the following paragraphs, led to three main predictions concerning varying exposure times.

Firstly, in two experiments using complex visual *learning* stimuli and a constant exposure time of 5 seconds, significant differences were found between neurotics and schizophrenics (3). In the present experiment very similar stimuli were used to measure *immediate recall*. This may introduce a new situation and should be borne in mind whenever facts related to learning and recall are broadly compared. As memory disturbance does not constitute a major clinical symptom of schizophrenia, and as learning impairment *sui generis* is by no means an established fact in schizophrenics, but may rather depend on co-operation (16), it was decided to find an explanation for the observed differences. As a first step, six normal Ss were tested using lysergic acid diethylamide (LSD) to produce schizophrenic-like symptoms and amytal as a possibly antagonistic drug to maximize differences between test scores (5). There was no specific reason for the choice of amytal, other than that LSD is classed as an excitant and amytal as a sedating drug. Highly significant differences were found, using the Figure Reconstruction Test (FRT) described in the present study, for a long exposure of 15 seconds only and not after shorter exposure times (1 and 1/100 second). Error was higher after LSD, as expected. From this, *prediction 1* of the present study was derived: that *neurotics and schizophrenics differ significantly in immediate recall only when a long exposure time is used.* Considerations from the LSD study determined the choice of a 30-seconds and a 2-seconds exposure time for the present study.

Additionally, the hypothesis was advanced that the exposure time effect is related to "rigidity" and should be measurable in neurotics. Following suggestions of Goldstein (14) and Fisher (10), schizophrenics were expected to possess a higher degree of rigidity than neurotics. From this, two further predictions were made. *Prediction 2* states that, with the questionnaires used in the present study, *rigidity is higher for schizophrenics than for neurotics.* *Prediction 3*, then, assumed *highly rigid neurotics to produce higher immediate recall error than those low in rigidity, selectively at the 30-seconds exposure time.*

The first of the two paper-and-pencil tests used to measure rigidity is the Nigniewitzky *Rigidity Scale* (18), which was found to correlate highly with other known similar scales, leading to a "factor of rigidity". As a second, rather different test, Soueiff's (22) check list to produce *extreme response sets*

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(RS) was chosen. Both tests are further described in the method section. Little is known as yet about the personality correlates of RS. Significant relationships of various types of rigidity questionnaires have, however, been reported and discussed on several occasions (22), which appear to justify the selection made.

The choice of memory, or learning, performance as a medium in which rigidity may manifest itself may be considered an obvious one (6, 1). Despite this, quite insufficient relevant experimental facts appear to have been reported to date.

Some *subsidiary aims* of the present study may be formulated as follows. Several personality theorists, using a rather more speculative approach, have preferred the use of single questionnaire criteria in this context. Thus, the Manifest Anxiety Scale (MAS) has played an important part in the work of Taylor, Spence and their co-workers, and the Extraversion Scale of the Maudsley Personality Inventory (8) in the investigations of Eysenck and his associates. The present author believes that the use of single criteria, at the present stage, restricts the sources of individual variation and may bias inter-pretation in favour of the selected criterion, leaving other, and possibly more important, sources unaccounted for. It is partly for this reason that criteria other than those of rigidity were employed in the present study. These are a scale of extraversion (E) and of neuroticism (N), taken from the Maudsley Personality Inventory.

The N scale was shown to be highly (0·92) correlated with the MAS (13). It may therefore be expected that the present results correspond in nature to those obtained by Taylor, Spence and co-workers. A number of experiments have shown that highly anxious Ss perform less well at more difficult tasks (17, 21). This leads to the expectation that Ss with a high N score would perform less well on the 2 seconds exposure test, as against the 30-seconds exposure. The same might apply, if anything, to the introverts, as MAS correlated negatively with an extraversion scale (Guilford Rathymia, −0·48, 13).

As to extraversion, Eysenck and co-workers (7) expected work decrement, as measured by a pursuit-rotor, to be more rapid and more marked in extraverts, as against introverts. Bearing in mind that the pursuit-rotor presents a task and conditions considerably different from the test used in the present study, a straightforward prediction may not carry much weight. An empirical analysis of the present results, in relation to extraversion, may nevertheless contribute to an assessment of the generality of the factor discussed.

Lastly, it was hoped to define more precisely the personality traits of the non-learner. This problem arose of consistent previous findings that a consider-able proportion of neurotics and psychotics did not improve at all in learning (FRT) despite a great number of practice trials (3).

METHOD

1. *The Figure Reconstruction Test* (*FRT, Immediate Recall*)

This test has been described in two previous papers (4, 5). In the present study it was used as shown in Figure 1 and the following:

Test shapes. Semi-circle, circle, triangle, square and oblong. Identical in all patterns.

Central reference point. Provided in stimuli and on response sheets of 23 cm. square in both cases.

General instruction. "Draw the five shapes around the central reference point on the response sheet as seen on the screen."
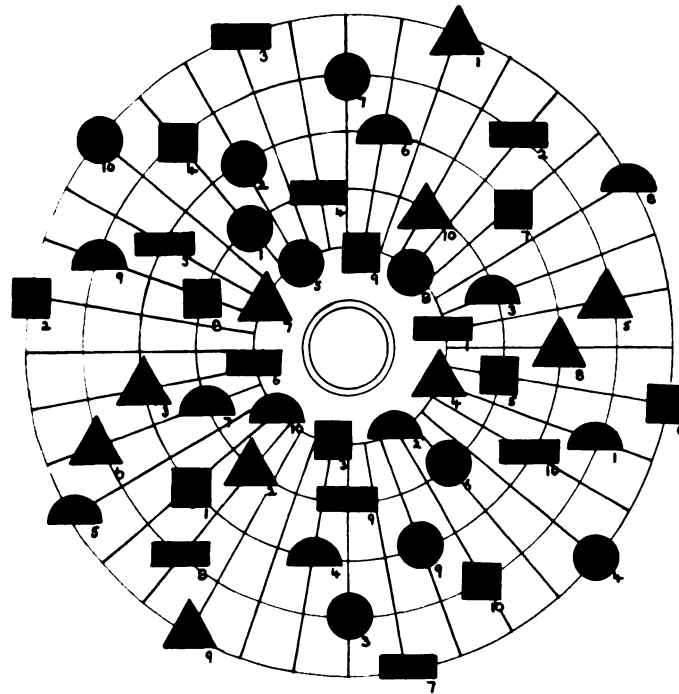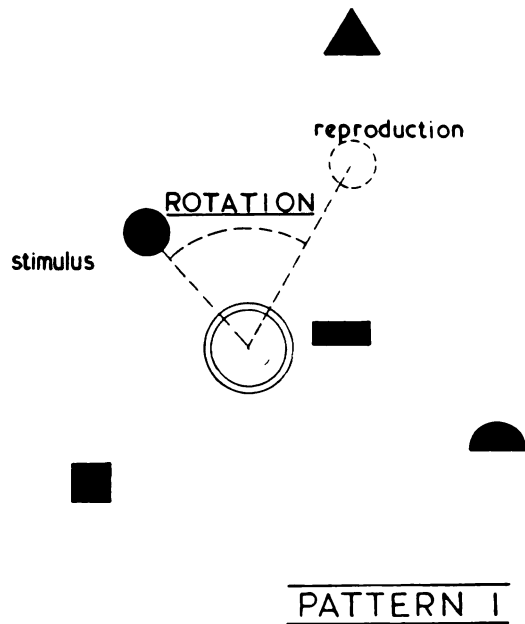
FRT immediate recall

Set of 10 patterns

ROTATION

reproduction

stimulus

PATTERN 1

FIG. 1.—*Above:* Complete test set of 10 patterns, distributed evenly. *Below:* Rotation error, or degree of axial displacement, demonstrated for one shape. For one test set, rotation error is the mean degree of rotation of 50 shapes.

Exposure method. Stimuli, drawn in Indian ink on white cardboard, were exposed on a black background. A complete set of the five test shapes, drawn large in a line, was clearly visible to the Ss throughout the experiment, so that type of shapes were known. All shapes *had* to be reproduced after each exposure.

Exposure time. Two conditions, of 30 and 2 seconds duration. Ss viewed stimulus through compur shutter.

Number of test sessions. The two exposure conditions were given twice in succession on successive days.

Balanced design. A total of four parallel sets, of ten patterns each, were prepared and presented in a balanced order.

Scoring rotation error. Rotation error was scored as the mean displacement per shape in degrees around the centre, as demonstrated in Figure 1. This score correlates highly with other types of error, scored from the same reproductions (3). It should be remembered that all shapes had to be reproduced for completeness of scoring.

2. *Personality Questionnaires*

The following scores were derived from all Ss but three schizophrenics:

$E = extraversion$, 24 items (MPI, Eysenck, 8).

$N = neuroticism$, 24 items (MPI).

$NR = Rigidity$, 28 items (Nigniewitzky, 18).

Extreme responses, positive plus negative $= 101$ item adjective check list (Soueiff, 22).

Extreme positive responses = as above.

Questionnaires were provided with "Yes", "No" and "?" response categories. On the E, N and NR scales two points were scored for each answer in the extraverted, neurotic and rigid direction and one point for a question mark.

The *E and N scales* have not stood up to the expectation of representing independent factors, as postulated by Eysenck (8). On a number of occasions, particularly in neurotics, introversion was found to be significantly related to neuroticism (results prepared for publication). The *NR scale*, recently developed, was shown to be fairly highly correlated with Intolerance of Ambiguity (Nigniewitzky), the California Psychological Inventory Rigidity Scale (French), the Rokeach Dogmatism Scale and the California F Scale (18). Factor analysis of the intercorrelations yielded a general factor of rigidity.

Extreme responses were derived from Soueiff's "personal friend" check list (22). Ss describe how much they like or dislike their personal friends of their own sex to have certain characteristics like "agreeing", "dependable", "witty", etc. The following five grades are used: $+2$, $+1$, 0, -1, and -2. "Extreme response, positive and negative" was scored as the sum of all $+2$ and -2. "Extreme positive response", was scored as the total of all $+2$ answers. The originally shorter list of Soueiff was increased to 101 items in view of a future item analysis.

The *intercorrelations* of the questionnaire scores, used in the present study, were as follows:

48 Neurotics	N	NR	Extr. $+2/-2$	Extr. $+2$
E	-0.38	-0.22	-0.07	0.02
N		0.09	0.05	0.09
NR			0.32	0.40
Extr. $+2/-2$				0.83
Extr. $+2$				—

Results presented in this paper were analysed as a function of E, N and combined NR/all Extremes. This use of the criteria is open to criticism on the basis of the above relatively high correlation between E and N and relatively low correlation between NR and Extremes. However, analysis showed results to be most profitably used employing this original plan. The combination of NR and Extremes, as careful inspection of the data suggested, did not seem to bias results.

3. Subjects

A description of the four groups of Ss used in terms of their mean age and questionnaire responses is shown below (Table I).

TABLE I

Description of Subjects Used in the Present Experiment

Means	Age	E	N	NR	Extr. +2/−2	Extr. +2
24 Male neurotics	34·5	21·6	32·4	30·5	38·2	16·7
24 Female neurotics	32·5	18·9	34·2	23·6	30·5	11·5
12 Male schizophrenics	27·5	22·5	32·9	35·5	42·3	23·9
12 Female schizophrenics	34·4	21·1*	20·3*	30·2*	31·8*	19·4*

* Scores based on N=9 only.

The *age range* was from 18 to 48 and overall differences between the four groups were not significant. Great care was taken to exclude patients who had received: any shock or drug treatment, other than night sedation, during the period of the present stay in hospital, evidence or suspicion of brain impairment, or damage, and patients considered by their doctor to be unsuitable for testing. Patients were taken off night sedation for two nights before testing started.

As to *diagnosis*, the experimenter relied entirely on the doctor's opinion of whether the patient was "definitely" a schizophrenic or a neurotic. In neurotics, any type of patient was accepted. In schizophrenics, patients whom doctors considered to be depressed were excluded in order to avoid possible interference by this symptom. The clinical diagnosis was either one of paranoia or of schizophrenia simplex.

As most patients are nowadays treated soon after admission by physical methods, as a rule only recent admissions were tested. The present stay in hospital, however, was up to four months. No S had been longer in hospital than one year at any time, nor had he/she been admitted more often than three times in all. This was done in order to avoid effects of long-term hospitalization and deterioration. Additionally, patients were not tested unless they were of "average intelligence", as judged by the ward sister. This, however, applied only in a very few cases. About three-quarters of the schizophrenics and all neurotics were voluntary patients. One of the selected neurotics and six schizophrenics refused to start or to continue testing.

In previous experiments of the present author, neurotics have been classified into clinical sub-categories in accordance with Eysenck's theory of extraversion-introversion (9). This method was abandoned for the present study because it proved an unsatisfactory criterion as regards the FRT. Eysenck's questionnaires may nevertheless be used as suitable personality criteria.

RESULTS

1. Effect of Exposure Time in Neurotics and Schizophrenics

Combining Tests 1 and 2, results for the 30-seconds exposure were as follows:

30 Seconds Exposure	12 Male Schizo-phrenics	12 Female Schizo-phrenics	24 Male Neurotics	24 Female Neurotics
Mean rotation error				
Tests 1 and 2 ..	30·33	35·08	24·92	25·63
Variance	86·24	111·90	55·65	44·25

An analysis of variance between these four groups, with 3/68 d.f., resulted in an F-ratio of 5·20, which is significant at the one per cent. level. Both pairs of groups, male schizophrenics and neurotics, as well as female schizophrenics
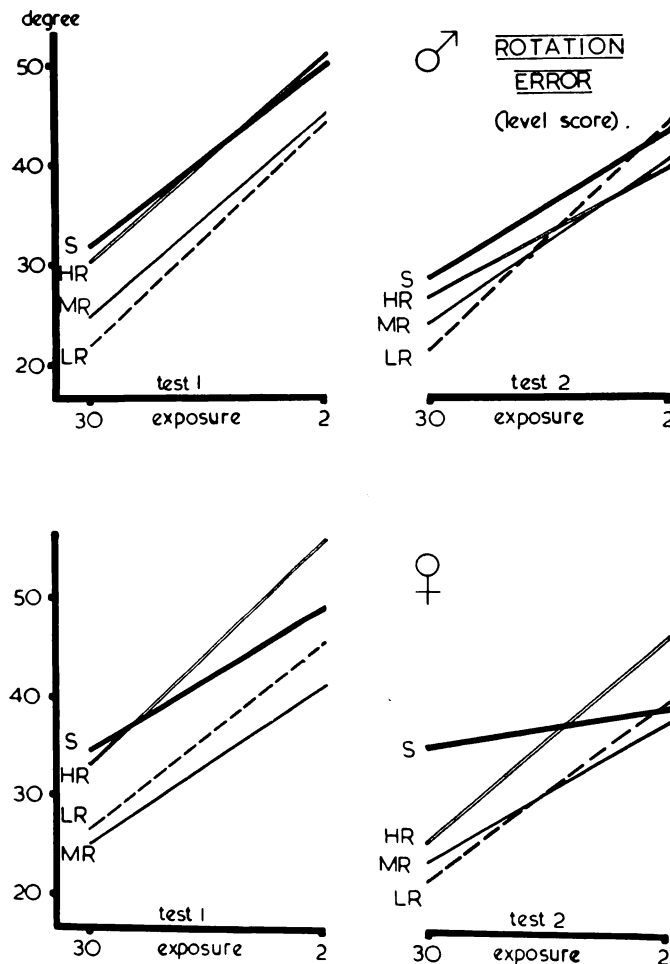
FIG. 2.—Schizophrenics scored significantly more error than the neurotics at the 30 seconds exposure, while performing practically identically at the two seconds exposure.

S = schizophrenics; HR, MR and LR = high, medium and low rigid neurotics.

and neurotics, differed significantly as shown by the respective t-ratios of 1·89 (5 per cent., 34 d.f., one tail) and 3·30 (0·5 per cent., 34 d.f., one tail).

There were *no significant differences between the two categories of patients on the two seconds exposure time*. In fact, the overall mean rotation error was practically identical, as may be seen from Figure 2.

Prediction 1 is confirmed in that immediate recall of schizophrenics as against neurotics is specifically impaired after long exposure time.

2. *Differences in Rigidity and Extreme Responses Between Neurotics and Schizophrenics*

To maximize differences male and female subgroups were combined. As was pointed out earlier, three of the 24 schizophrenics refused to complete the questionnaires. Results are stated below:

Rigidity (Nigniewitzky) and Extreme Responses (Soueiff)	Rigidity		Total Extremes		Positive Extremes	
	$\bar{X}$	s^2	$\bar{X}$	s^2	$\bar{X}$	s^2
48 Neurotics　.. 　..	27·04	89·66	34·33	245·42	14·08	79·65
21 Schizophrenics　..	33·24	59·49	37·76	380·59	21·90	229·88
t-ratio (Signif.) (67 d.f., one tail)　..　..	2·64 (1%)		0·78 (NS)		2·65 (1%)	

Prediction 2, stating that rigid and extreme responses are more frequent in schizophrenics than in neurotics, is confirmed. It is important to note for future development of such scales, using extreme responses, that the differences regarding this measure were entirely due to the *positive* extremes. Negative extremes were less frequent in schizophrenics than in neurotics.

3. *Exposure Time Effect on Rigidity in Neurotics*

With the second prediction verified, a test of prediction 3 becomes possible. This states that rotation error, using a 30 seconds exposure time, increases with the degree of rigidity in neurotics. Each male and female neurotic subgroup was divided into three equally large groups using the combined rank orders of the NR and total extreme response scores. These subgroups of low, medium and high rigidity consisted then of eight males and females each. Combining sexes, as well as scores derived from Tests 1 and 2, the results were as follows (compare Fig. 2).

30 Seconds Exposure (all neurotics)		"Rigidity" (NR and Extremes Combined)		
		16 Low	16 Medium	16 High
Rotation error (Tests 1 and 2 combined)	$\bar{X}$	22·25	24·44	29·13
	s^2	35·53	43·86	47·85

F-ratio between 3 groups = 5·65 (2/45 d.f., significant at the 1 per cent. level).

Differences were in the expected direction and significant, as shown by the

analysis of variance between the three groups. A subsequent t-test analysis, carried out separately for the two sexes, provided the following results.

30 Seconds Rotation Error (Tests 1 and 2 combined)		Low Rigidity	High Rigidity	t-ratio (significant)
Male neurotics	$\bar{X}$	21·88	28·63	1·98
	s^2	43·27	63·41	(5%)
Female neurotics ..	$\bar{X}$	22·63	29·63	2·51
	s^2	32·55	38·55	(2%)

8 Ss in each of the 4 subgroups; 14 d.f., one tail tests. Rigidity=NR and extreme response combined.

A similar analysis, conducted for the 2 seconds exposure time, did not reveal any significant differences, although it may be seen from Figure 2 that highly rigid neurotics scored more error than patients of medium and low degree of rigidity. A comparison of high and low rigid subgroups resulted in a t-ratio of 1·30 (30 d.f.) and one of high with combined medium and low rigidity in a corresponding ratio of 1·67 (46 d.f.). *Prediction 3* may thus be considered verified that rotation error increases with the degree of rigidity in neurotics, provided a long exposure time is used. It may be mentioned, finally, that in both males and females not the low but the medium subgroup scored lowest error.

4. *Extraversion Score and the Exposure Time Effect*

Males and females were divided into three subgroups of equal size. The mean rotation scores were as follows (Table II).

TABLE II

Mean Rotation Error Scores Pertaining to Figure 3, Upper Part

	Mean Rotation Error			Introverts	Medium Group	Extraverts
MALES	Test 1	30 seconds	.. ..	24·9	26·8	25·3
		2 seconds	.. ..	44·5	45·3	50·3
	Test 2	30 seconds	.. ..	25·0	24·9	21·3
		2 seconds	.. ..	36·4	35·1	52·1
FEMALES	Test 1	30 seconds	.. ..	26·0	30·5	28·5
		2 seconds	.. ..	47·9	47·1	47·8
	Test 2	30 seconds	.. ..	20·8	25·1	24·9
		2 seconds	.. ..	33·5	38·6	51·6

From this table it may be seen that the largest and most consistent differences in means appeared at Test 2 (retest after 24 hours), using the 2 seconds exposure time. These relationships are further demonstrated in Figure 3, upper part.
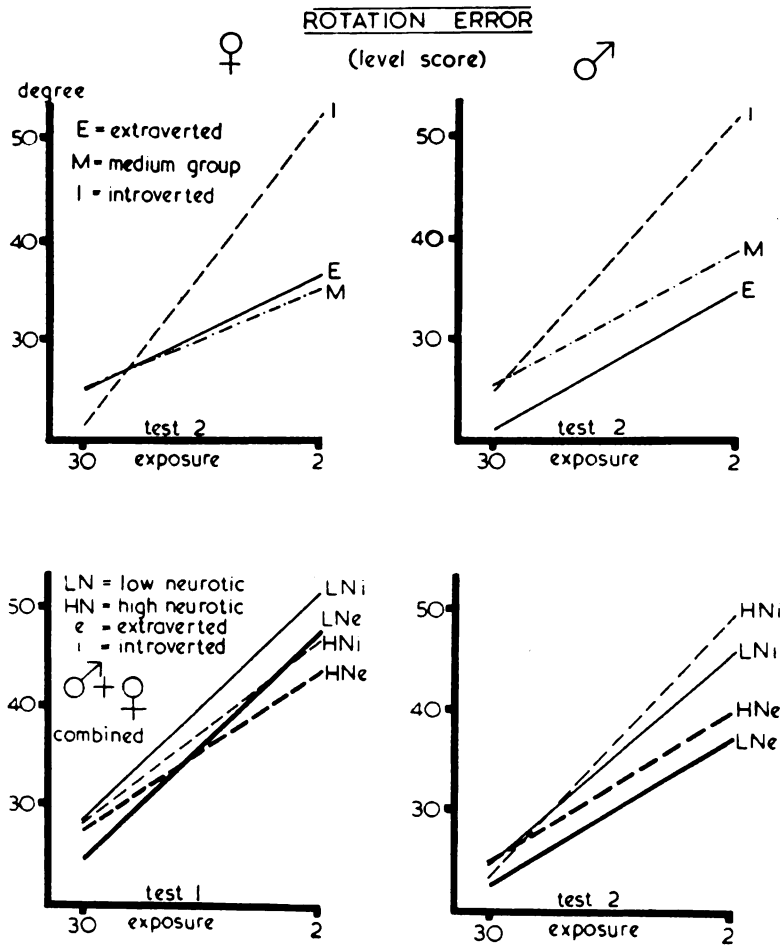
FIG. 3.—*Upper part:* At the 2 seconds exposure introverts scored significantly higher error than the other groups. *Lower part:* Tendency of error to increase with neuroticism after practice.

A corresponding analysis of variance for the 2 seconds exposure (Test 2) showed differences between the three groups, sexes combined, to be significant, as seen below.

2 Seconds Exposure Rotation Error	16 Extraverted	16 Medium Group	16 Introverted
Mean	34·94	36·88	51·88
Variance	122·20	92·78	111·85

F-ratio between 3 groups = 12·62 (2/45 d.f., 0·1 per cent. level of significance). Test 2 only, males and females combined.

t-ratios between the combined medium and high extraverts and the introverts were as follows:

2 Seconds Exposure Rotation Error		Introverts (8 per subgroup)	Medium and High Extraverts (16 per subgroup)	t-ratio (significant)
Males ..	$\overline{X}$	52·12	35·75	3·53
	s^2	169·55	88·87	(1%)
Females ..	$\overline{X}$	51·63	36·06	3·43
	s^2	69·98	128·06	(1%)

22 d.f., two-tail tests.

The conclusion may be drawn that, using a 2 seconds exposure time, rotation error of the introverts was significantly worse than that of the remaining subgroups.

5. *Neuroticism Score and the Exposure Time Effect*

This score was not significantly related to the effect discussed. Neurotics, however, who scored high on N, as against low N, had a slightly lower mean rotation error score on Test 1 as against a slightly higher one at Test 2, considering the 2 seconds exposure only. This observation, made from Figure 3, lower part, is discussed further under "practice effects". In this Figure, the 48 neurotics were divided first into two groups of the 24 most extraverted and 24 most introverted subjects, thus considering the already noted extraversion effect. These subgroups were halved on the basis of the N scores as criteria for high and low neuroticism. It appears that in both, the introverted and the extraverted subgroup, rotation error is higher by approximately the same degree for the "more neurotic" portion. This effect did not approach the 5 per cent. level of significance.

6. *Practice Effects*

A substantial proportion of both the neurotics and schizophrenics showed no gains with practice between Tests 1 and 2, as demonstrated in the following:

Percentage Non-learners						Exposure	
						30 Seconds	2 Seconds
24 Schizophrenics	..	..	..	..	..	37	37
48 Neurotics ..	..	..	..	..	..	35	40

These results are remarkably similar between the two groups of patients as well as between the exposure times. The following analysis, shown in Figure 4, describes in more detail the relationship between practice effects and questionnaire scores. Each time, subgroups represent half the entire number of Ss in the neurotics. The schizophrenic groups are added for comparison.

A complete agreement between males and females can be seen as far as trends of curves and means at the 2 seconds exposure are concerned. With 30 seconds of exposure, positions of means of male and female neurotics disagree consistently. An analysis of variance, testing the various components against

ROTATION ERROR
(practice gain)

E = extraverted　　HN = high neurotic　　HR = high rigid
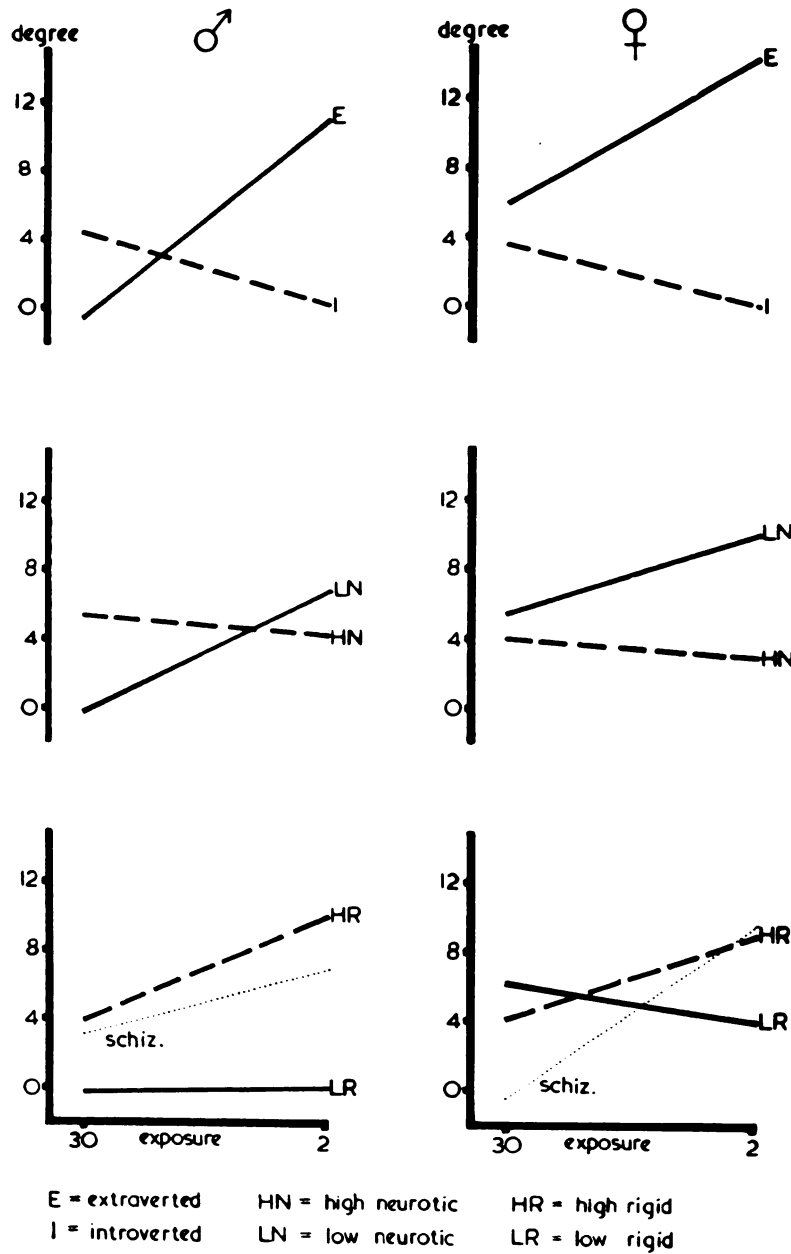I = introverted　　LN = low neurotic　　LR = low rigid

FIG. 4.—Mean practice scores for Tests 1 and 2. N=12 per subgroup.

the residual, was performed separately for E, N and R. Subgroups differed significantly in the case of extraversion and rigidity, as seen in the following:

F-ratio (Significant)	Sex	Exposure	Groups	E×G
Extraversion	4·32 (5%)	N.S.	14·47 (0·1%)	20·10 (0·1%)
Neuroticism ..	N.S.	N.S.	N.S.	N.S.
Rigidity ..	N.S.	N.S.	4·49 (5%)	N.S.

1/44 d.f.

A complete statistical description pertaining to Figure 4 is provided in Table III.

TABLE III
Rotation Practice Effects in Degrees Between Tests 1 and 2:
Means and Variances Pertaining to Figure 4

Rotation Practice Subgroups with 12 Ss Each		30 Seconds Exposure Mean	Variance	2 Seconds Exposure Mean	Variance
Male neurotics	E ..	−0·4	95·0	10·8	115·6
	I ..	4·3	26·6	0·1	165·7
Female neurotics	E ..	6·0	123·5	14·2	117·6
	I ..	3·5	73·9	−1·5	131·5
Male neurotics	HN ..	5·3	74·4	4·2	238·2
	LN ..	−1·5	33·5	6·8	102·6
Female neurotics	HN ..	3·9	74·3	2·8	212·8
	LN ..	5·6	125·0	9·9	142·3
Male neurotics	HR ..	4·0	82·0	10·1	103·0
	LR ..	−0·2	42·0	0·8	194·7
Female neurotics	HR ..	4·3	81·5	8·5	213·7
	LR ..	5·2	118·9	4·2	159·1
Male schizophrenics		3·2	108·5	6·9	230·8
Female schizophrenics ..		−0·5	111·4	9·5	121·4

E=extraversion. I=introversion. N=neuroticism. R=rigidity. H=high. L=low.

Following this, a t-test analysis was carried out. For the *30 seconds exposure* no significant differences were found between any of the pairs of groups shown in Table III. For the *2 seconds exposure*, results were as follows:

t-ratio (significant)	Extraverted *vs.* Introverted	High Neurotic *vs.* Low Neurotic	High Rigidity *vs.* Low Rigidity
Male neurotics	2·22 (5%)	N.S.	2·19 (5%)
Female neurotics	3·44 (1%)	N.S.	N.S.
Combined males and females	4·03 (0·1%)	N.S.	3·21 (1%)

22 d.f. for single, 46 d.f. for combined groups. Two-tail tests

The conclusion is drawn that practice effect was significantly associated with extraversion and rigidity, but not with neuroticism. The consistent tendency for high neurotic persons to improve less should, nevertheless, be noted. Schizophrenics, under the present conditions, were not significantly different from the neurotics. The trend is pointed out that schizophrenics gained *less* with the 30 seconds and *more* with the 2 seconds exposure than the neurotics taken together, as follows:

| | Exposure | |
Mean Practice Effect	30 Seconds	2 Seconds
24 Schizophrenics	1·3	8·2
24 Male neurotics	1·9	5·4
24 Female neurotics	4·8	6·3

7. Practice Effects for Combined Criteria

In Figure 4, it was shown that high rigid and extraverted neurotics learned considerably faster than low rigid and introverted subjects. This effect was practically independent of the respective subgroup's initial error scores (Test 1), because of the lack of significant differences between any of them. The feasibility of combining criteria with the aim of better differentiation is for this reason and for the differential functional effects involved suggested in the following. Ss who scored above the group mean of both rigidity and extraversion are now compared with those who scored consistently below. Of the male neurotics 14 Ss and of the females 12 Ss fulfilled this criterion. Firstly, it is shown that the mean practice scores of the selected groups are well outside those of the unselected groups, represented in Figure 4.

Mean Rotation Practice	Males	Females
HR/E (selected)	13·1	18·3
Entire group	5·4	6·3
LR/I (selected)	−4·0	−1·7

The individual scores of the selected groups were as follows:

| 14 Males | | 12 Females | |
HR/E	LR/I	HR/E	LR/I
20	−2	22	−19
1	−19	24	−4
17	−14	0*	−8/M
−4*	−12	16	5/M
16/M	−8/M	28/M	−1/M
21/M	4/M	20/M	17/M
21/M	23/M		

* Ss with extremely low error score at Test 1. M = Ss scoring in the medium third portion of rigidity, rest scoring extreme.

Considering the fact that the lowest scoring S in each male and female HR/E subgroup had an extremely low error score at Test 1 and, therefore, could hardly be expected to improve considerably, the differences between the two sets of individual scores are consistently high. A possible tendency for E with a medium rigidity score, designated as M, to show greatest practice gains should be noted for future work. Finally, it may be mentioned that using the combined rank order of *practice* and Test 2 *level* scores (2 seconds exposure only), *only one person* was misclassified and another one ended in a tie in both the male and female group.

8. Intercorrelations of Rotation Error Scores

The following coefficients of correlation were obtained, based on all 48 neurotics.

Level score: 2 seconds—Test 1   *vs.*   30 seconds—Test 1   0·48
                      2 seconds—Test 2   *vs.*   30 seconds—Test 2   0·41
Practice score: 2 seconds   *vs.*   30 seconds   0·28

The level score intercorrelations are rather low considering that the task was identical in nature and difficulty, and was exposed only under somewhat different conditions. The corresponding correlations between the two practice scores is, as expected, lower still and just about significant at the 5 per cent. level only. The problem arising from this is: which personality factors interfere with performance so seriously as to render practice effects of two identical tasks, under slightly varying conditions, highly "specific"? This point is analysed in the following paragraph.

9. *Correlations Between Error and Questionnaire Scores*

Error level and practice scores were correlated with the questionnaire scores as follows (N=48 neurotics):

Correlations	Level Test 1		Level Test 2		Practice	
(Exposure seconds)	2	30	2	30	2	30
Extraversion ..	−0·08	−0·20	**−0·44**[2]	−0·01	**0·35**[1]	−0·17
Neuroticism ..	0·01	0·27	0·17	0·21	−0·16	0·06
Nign.—Rigidity	**0·28**[1]	**0·31**[1]	0·09	0·03	0·19	0·25
Extremes (+2/−2)	0·16	0·16	0·08	0·17	0·07	−0·01

Significance: [1]=5 per cent.; [2]=1 per cent. level.

From this at least two points may be noted. *Firstly*, extraversion correlated higher (−0·44) with the 2 seconds level score (Test 2) than the 30 seconds level score (0·41, paragraph 8). Correspondingly, extraversion correlated higher (0·35) with the 2 seconds practice score than the 30 seconds practice score (0·28). *Secondly*, rigidity (NR) correlated significantly with error level at Test 1 only, regardless of the exposure time. At Test 2, the corresponding correlations were practically zero.

From this the conclusion may be drawn that personality factors interfere with level and practice scores to a degree at least as high as does the ability to perform an identical type of test, presented under somewhat different conditions of exposure time. These effects appear to bear specific time relationships. It is suggested that the effect of extraversion increases from practically zero significantly with practice under short exposure time conditions only. With prolonged exposure (30 seconds) the opposite trend is noted. Rigidity, as measured by the Nigniewitzky scale, reveals a different type of effect. This trait is positively related to error in initial stages of practice under both exposure conditions alike. The effect is reduced with practice and almost completely removed at the second test.

DISCUSSION

The main aim of the present paper, regarding a specific recall impairment after long exposure, has been fulfilled. Schizophrenics, as against neurotics, and Ss with high, as against low degree of rigidity, differed in the expected directions. This finding explains why, on two previous occasions, schizophrenics were found to be worse learners than neurotics (3), simply on account of the sufficiently long exposure time used.

The fact that the short (2 seconds) exposure time did not yield significant differences with the same criteria exactly parallels the differences found between LSD and amytal (5). Together with the greater mean practice gain in schizophrenics at the 2 seconds exposure, as compared with the neurotics, a further suggestion may be made. It may be assumed that poorer performance of schizophrenics is basically dependent on experimental conditions of the kind described, rather than on level of co-operation, which was shown by Huston and Shakow (16) to be an important variable and that co-operation itself is a function of such conditions. The selectively long exposure impairment of schizophrenics, rigid neurotics and normals after LSD administration aptly fits the observation of a lacking "ability to maintain a level of mental preparedness" over a long time (15).

The expectation that highly neurotic and introverted Ss are more affected by a complex (2 seconds exposure) task than their counterparts, given a certain amount of practice, has been realized. Thus, results achieved with the MAS, described in the introduction, are paralleled using a rather different test as well as conditions. The more recent results of Saltz and Hoehn (20), as described in their Figure 1, are almost exactly duplicated despite a widely different technique. It should, however, be borne in mind, as demonstrated in Figure 3, that the "neuroticism content" of the MAS is not likely to be as much responsible for the results obtained as is the "introversion content" (compare introduction). Finally, it may be stated that significant differentiation, hitherto obtained with the MAS, was with difficult or complex tasks and not with easy tasks. With the present results, regarding rigidity, it has been demonstrated that rather independent traits or motivations should be considered at different levels.

This is brought out in Figures 2–4, as well as in the correlations between tests and questionnaires. Extraversion and rigidity appear to have quite specific exposure time and practice stage relationships with error. It is evident from this that an investigation might profitably be made seeking to determine directly the interference of the most relevant personality factors with various stages of practice, as has been done for ability and cognitive tests by Fleishman and Hempel (11, 12). Changes in factor structure at various such stages, have by these authors, been investigated and interpreted to the exclusion of personality terms, which can now confidently be expected to play a considerable role.

The finding that extraverts improved considerably faster than introverts on the 2 seconds exposure does not appear consistent with Eysenck's expectation that, with increasing practice, introverts improve faster (7). Additionally, using a 5 seconds exposure time, a number of previously tested groups of normals and neurotics, classified as extraverts and introverts in the Eysenckian sense, showed extraverts to be faster learners than their counterparts (3). These differences, as stated in the introduction, may be due to the selection of test and conditions in the present study.

A few further points may be noted. Correlations between rigidity and error level were significant at Test 1 and almost zero at Test 2. This did not appear to affect the differentiation between the groups which, in fact, became clearer as to the group placement (Fig. 2). Similarly, both high rigid and extraverted Ss were the fastest learners and showed identical functional relationships despite the *negative* correlation between NR and E ($-0\cdot22$). It should also be realized that the effect related to rigidity, under the present test and exposure conditions, did not disappear with practice, as has been the case in other types of investigations. This is inconsistent with the sometimes held belief that rigidity manifests itself only in situational anxiety and disappears with practice.

In questionnaires, females were less rigid and used fewer extreme responses, which is well in agreement with the usual findings (19, 23). This sex difference, however, did not become manifest in the objective test results.

As a final point, attention is drawn to the result that only *positive* extreme responses differentiated schizophrenics from neurotics. A pending analysis to this point has, in the meantime, shown that only positive extremes were consistently positively correlated with the Nigniewitzky Rigidity Scale, using a number of independent samples of normals and neurotics. This is considered to agree with the finding of Block and Petersen (2) that "overly confident people tended to be rigid and dogmatic". A present item analysis of the Soueiff check list reveals that various groups of neurotics, drawn from different hospitals, tended to make significantly more negative responses than normals and schizophrenics. Additionally, it is found that schizophrenics differ in content of the items responded to in extremes. From this discussion it may be seen that the author is by no means satisfied with the criteria of rigidity, as used in the present study. They have, however, served to further the analysis on a number of points.

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