

# REMINISCENCE, DRIVE, AND PERSONALITY THEORY<sup>1</sup>

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SEVERAL attempts have been made in recent years to integrate personality study and learning theory. Of particular value in this connection has been the work of Mowrer (27), Dollard and Miller (4), and Spence (30, 31, 32). The reasons why these attempts cannot be regarded as wholly successful have been discussed elsewhere, and a "dynamic theory of anxiety and hysteria" (11) has been proposed, which attempts in a formal manner to relate the postulates of learning theory to an empirically founded and experimentally tested description of certain major personality variables.

This system of personality description has been reported in detail (7, 8, 9, 10). For the present purpose, it must suffice to say that two independent dimensions of personality (neuroticism and extraversion-introversion) have been identified quantitatively. These dimensions are related to classical psychiatry in the manner indicated by Jung: hysterics and psychopaths have high scores on both extraversion and neuroticism; whereas dysthymics, suffering from depression, anxiety states, or obsessional and compulsive symptoms, have high scores on both neuroticism and introversion. (It is not assumed, of course, that these two dimensions are the only ones which describe human conduct; what is maintained is simply that these are two very important dimensions, the understanding of which would make possible the description and control of a considerable proportion of human behavior.

## PROBLEM

The postulate that links the dimensions of extraversion-introversion with modern learning theory and specifically that system of constructs used by Pavlov (29) and Hull (19) is called the typological postulate, and has been formulated thus:

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Individuals in whom reactive inhibition is generated quickly, in whom strong reactive inhibitions are generated, and in whom reactive inhibition is dissipated slowly, are thereby predisposed to develop extraverted patterns of behavior and to develop hysterico-psychopathic disorders in case of neurotic breakdown; conversely, individuals in whom reactive inhibition has developed slowly, in whom weak reactive inhibitions are generated, and in whom reactive inhibition is dissipated quickly, are thereby predisposed to develop introverted patterns of behavior and to develop dysthymic disorders in case of neurotic breakdown" (11, p. 35).

This postulate mediates a large number of predictions in the fields of learning theory and perception. One of these predictions, relating figural aftereffect to extraversion, has been verified in a previous paper (12, 28). Another prediction, relating conditioning to introversion, has been verified by Franks for both neurotic and normal Ss (15, 16). The present paper is concerned with a third prediction, relating to the phenomenon of reminiscence. If, as is maintained with good evidence by Hull (19) and others (26), reminiscence phenomena are the product of inhibition originating in the massing of practice, then it follows from the typological postulate that *extraverts should show a higher degree of reminiscence than introverts*. The argument is probably too obvious to require much elaboration. Massed practice produces inhibition; inhibition is generated more quickly in extraverts; consequently, massed practice produces a greater amount of inhibition in the extraverted group. Reminiscence is produced by the dissipation of the accumulated inhibition during a rest period; reminiscence, therefore, is proportional to the amount of inhibition accumulated during massed practice. Extraverts who have accumulated more inhibition will therefore have more inhibition to dissipate and will consequently show greater reminiscence effects (11).

## METHOD

*Apparatus.* The apparatus used was a traditional pursuit rotor. The turntable was 10 inches in diameter; the metal disc was  $\frac{3}{10}$  inch in diameter, and the distance between the center of the turntable and the center of the disc was  $3\frac{1}{4}$  inches. The Turntable revolved clockwise at a speed of 72 r.p.s.; S attempted to keep the

tip of an articulated rod in contact with the metal disc, having been given the standard instructions to move the rod in a circular manner and not to press down on the turntable. The experiment was carried out in a blacked-out room with controlled artificial illumination equal for all *Ss*. Recordings were made of the length of time during which the tip of the rod was in touch with the rotating disc during successive 10-second periods, an automatic device switching the recording between two recording chronometers every 10 seconds.

*Procedure.* There were three experimental sessions, divided from each other by 10-minute rest pauses. Each of the experimental sessions consisted of 30 successive 10-second trials, so that as far as the *S* was concerned he was working constantly for 5 minutes, had a break of 10 minutes, worked another 5 minutes, had another break of 10 minutes, and then worked another final 5 minutes. These conditions followed Ammons (2), who showed that this combination of massed practice and rest periods gives near optimum conditions for the emergence of reminiscence phenomena. Two breaks, rather than the more usual single break, were introduced in order to determine the reliability of the reminiscence score.

*Subjects.* The sample tested consisted of 50 experimentally naive male university students who were paid for their services. These students were volunteers who came to the Institute of Psychiatry for one day, during the course of which they were subjected to a number of different experiments. The pursuit rotor was applied relatively early during the day, so little generalized fatigue is likely to have been operative. No measures of intelligence were taken as the evidence tends to show that intelligence is not related to pursuit-rotor performance at IQ levels above 100. (The mean IQ level of similar groups used in previous experiments has usually been in the neighborhood of 120, with an *SD* of 10.) It is also known that correlations between intelligence on the one hand and neuroticism and extraversion on the other are very low or nonexistent. Little is known about the influence of age, but as the group was relatively homogeneous in this respect, few being below 19 or above 25, it does not seem likely that the results could have been influenced to any important extent by these variables.

*Criterion tests.* It is obviously crucial for the proper test of the hypothesis that a reasonably reliable and valid estimate of extraversion-introversion and neuroticism should be available. As has been argued elsewhere (9), the most desirable type of evidence comes from a battery of devices, including ratings, self-ratings, objective tests, and physiological measures. It was impossible on this occasion to apply a whole battery of this kind and a single measuring instrument was reluctantly used. This instrument was the Maudsley Personality Inventory.

This questionnaire consists of two scales containing 24 items defining extraversion-introversion and 24 items defining neuroticism, as well as buffer items and a lie scale. The extraversion-introversion scale has a corrected split-half reliability of .77; the neuroticism scale one of .88. The correlation between the two scales is  $-.05$  (these figures are derived from the original standardization sample of 200 men and 200 women).

The scales were derived by means of an extensive

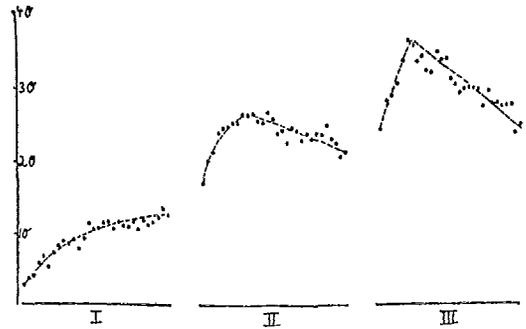


FIG. 1. MEAN PERFORMANCE ON THE PURSUIT ROTOR

The score plotted is percentage of time on target during successive 10-second trials in three 5-minute periods of massed practice, interrupted by two 10-minute rest pauses ( $N = 50$ ).

item analysis from Guilford's STDCR and GAMIN questionnaires, and the Maudsley Medical Questionnaire. Some of the evidence relating to the development of the Maudsley Personality Inventory has been discussed elsewhere (9), but no detailed discussion of the final questionnaire has yet appeared.<sup>2</sup>

## RESULTS

*Reminiscence.* Figure 1 shows in graphic form the average scores of the 50 *Ss* during the three sets of 30 trials. For ease of discussion, successive trials will be referred to by Roman numerals to indicate the first, second, and third sessions, and by Arabic numbers to indicate the trial within each experimental period. Thus, II-30 is the last (thirtieth) trial during the second period, and III-1 is the first trial during the third period. The figure shows that the main effects of experiments of this type are clearly present. These are (a) the reminiscence effect itself or the rise in performance from I-30 to II-1 and from II-30 to III-1; (b) a "warm-up" effect after the rest periods, continuing roughly from II-1 to II-10 and from III-1 to III-7; (c) a decline in performance after the peak of the "warm-up" period has been reached.

The score used here to represent individual differences in reminiscence was the difference between the average of the three last pretest trials and the first posttest trial. This measure does not take into account the practice effect of the last trial of a session, but this is probably more than compensated by not including the warm-up effect. The reason for taking the average of 3 scores as an estimate of pretest

<sup>2</sup> Copies may be obtained from the writer.

performance is simply the greater reliability of such an average as compared with a single 10-second trial score, coupled with the fact that performance appeared to have reached an asymptote. (This statement is more obviously true of I than of II.) Postrest performance cannot be measured in a similar manner because of the rapid rise of the curve (II-1 to II-10, and III-1 to III-7).<sup>3</sup>

Under these conditions, the correlation between the two reminiscence scores was .44 which, while highly significant, is clearly not very satisfactory. There are likely to be several reasons for this low reliability. The first and major one probably lies in the very high variance attaching to any single 10-second score. Chance factors, as is well known, play an enormous role in performance on the pursuit rotor. It is customary to get rid of such factors by averaging large numbers of trials or Ss. To do so is not possible in the case of individual measurement, however, and as single 10-second trials play a considerable role in the formula used here for measuring reminiscence, there is obviously a considerable amount of error variance involved in this measurement.

Another difficulty which may account for the low correlation stems from the fact that during the performance of an experiment such as this, a considerable amount of  $sI_R$  accumulates. This does not dissipate during rest, although, as argued above, some of it is extin-

<sup>3</sup> Ammons (1) has suggested a different method for the scoring of reminiscence, involving a correction for warm-up decrement. In an unpublished series of experiments, the writer has found evidence to suggest that Ammons's method of correcting for this decrement is based on a faulty theory of warm-up. The preferable alternative theory somewhat resembles that put forward by Denny *et al.* (3) to account for the fact that Ss who changed from massed to distributed practice soon reached the performance level of Ss who had been practicing under distributed conditions all the time. In brief,  $sI_R$  accumulates during the first period and, being a habit, is not dissipated during the first rest period. At the beginning of Period II,  $sI_R$  fails to be reinforced because of the absence of  $I_R$  at the beginning of the new testing period and after a long rest during which all reactive inhibition has been dissipated. Because of this failure of reinforcement,  $sI_R$  is extinguished, and consequently a steep rise in performance occurs. (The same explanation, of course, obtains in the case of the first seven trials in Period III.) If this account is accepted as a sound explanation, then clearly Ammons's method of measuring reminiscence confounds the effects of  $I_R$  and  $sI_R$  in proportions depending on the precise experimental arrangement.

guished during the so-called warm-up period. The amount of conditioned inhibition which develops is a function of (a) the amount of reactive inhibition, the dissipation of which during involuntary rest pauses is supposed to act as a reinforcement; (b) the amount of drive, which determines the level reached by reactive inhibition before these rest pauses take place, and thereby indirectly the number of rest pauses during a given period; and (c) the conditionability of the S. Depending as it does on these three variables, conditioned inhibition must be considered to vary relatively independently of reactive inhibition, thus acting as a major source of error. Kimble (20, 21, 23, 24, 25) has shown that reactive inhibition develops early and tends to remain relatively constant, whereas conditioned inhibition develops late and increases in a negatively accelerated fashion. It follows that the second measure of reminiscence ( $RS_2$ ) would be far more disturbed by the error variance introduced by conditioned inhibition than would  $RS_1$ . If this view is correct, it would explain in part the low correlation between the two, and it would also suggest that  $RS_1$  should produce higher correlations with the indices of extraversion and neuroticism than  $RS_2$ .

*Personality correlates.* The correlation between extraversion and the first reminiscence score is .29, significant at the .02 level by an appropriate one-tailed test. The correlation with the second reminiscence score is .10, which is not significant. The expectation of higher correlations with  $RS_1$  than with  $RS_2$  is thus borne out in the absolute magnitudes, but the difference is not significant statistically. The correlation between extraversion and the sum of the two reminiscence scores is .22, which just fails of significance at the .05 level. The correlation between neuroticism and  $RS_1$  is .40, significant at the .01 level. That between neuroticism and  $RS_2$  is .27. The second score is lower than the first, but not significantly so. When the two reminiscence scores are summed, they correlate .34 with neuroticism. This correlation is significant at the .02 level. (The significance of the correlations between neuroticism and the reminiscence scores was assessed by means of a two-tailed test, as no prediction was made as to direction.)

The correlation between the questionnaire measures of extraversion and neuroticism in

this sample is quite insignificant ( $r = .115$ ). It would therefore appear justifiable to conclude that about 25 per cent of the total variance of the reminiscence score  $RS_1$  is predictable in terms of the two personality variables; only about 8 per cent of  $RS_2$  is predictable in those terms. It would not be correct to say that personality factors, such as neuroticism and extraversion, *determine* the degree of reminiscence shown. Both reminiscence and personality factors are conceived of in this theory as determined by more fundamental causes, such as the inhibition/excitation balance, or the amount of autonomic drive present in a person. These are presumed to be largely innate features of the central and autonomic nervous systems respectively (13, 14) although this aspect of the theory is perhaps the one least strongly supported by direct experimental evidence. However, whether innate or acquired, these hypothetical properties of the nervous system are in this theory considered to underlie individual differences in *both* personality and learning.

*Practice, decline, and warm-up.* In view of the paucity of information on individual differences in various aspects of pursuit-rotor learning, it may be of interest to report some of the observed relationships. The first of these is the practice effect, defined arbitrarily as terminal score minus initial score, and obtained by subtracting the first three scores on the first 5-minute practice period from the last three scores. Theoretically, this effect would be facilitated by a strong excitatory potential and depressed by a strong inhibitory potential, so that it would be expected to correlate negatively with  $RS_1$  and  $RS_2$ . The correlations are, in fact, both negative ( $-.48$  and  $-.18$ ). As, however, the sum of trials 28, 29, 30 in the first period enters into both  $RS_1$  and the score of the practice effect, the higher of these two correlations may in part be an artifact, and as the lower one is not independently significant, no conclusions can be derived from these data.

The correlations of practice score with extraversion and neuroticism are both negative ( $-.103$  and  $-.154$ ); these are both in the expected direction, but cannot be interpreted as differing significantly from zero.

A decline score was calculated for Periods II and III by subtracting the sum of the three terminal scores (II-28, II-29, and II-30; and III-29,

and III-30) from the sum of the highest III-28, three consecutive points reached in these two sessions. The hypothesis was that this decline would in part be due to reactive inhibition and should, therefore, be positively correlated with reminiscence. The two correlations in question were both positive (.06 and .31). The latter is almost significant at the .01 level, using a one-tailed test; the former is not significant. The reliability of this decline score is relatively low, with the correlation between the two decline scores only .13. It is likely that this low correlation is in part due to the differential influence of conditioned inhibition at different points on the learning curve.

A measure was taken of the warm-up effect by subtracting II-1 and III-1 respectively from the highest successive three scores obtained on Sessions II and III. These measures of warm-up show a just significant reliability, the correlation between the two being .32. Warm-up scores are negatively correlated with reminiscence, the warm-up in II correlating  $-.69$  with  $RS_1$  and  $-.35$  with  $RS_2$ . The warm-up in III correlated  $-.30$  with  $RS_1$  and  $-.69$  with  $RS_2$ . Again, the higher of these values are suspect as the same term enters into both sides of the correlation. Such is not the case, however, for the two smaller correlations, and it therefore seems to be established that the amount of warm-up observed is negatively related to the amount of reminiscence. The correlations between warm-up and both extraversion and neuroticism are all negative, but well below significance. It would be unsafe to assume that warm-up as measured here is related to either of these two dimensions of personality.

#### DISCUSSION

Little discussion appears to be necessary with respect to the relationship found between extraversion and reminiscence. The prediction made from the typological postulate was verified at an acceptable level of significance. It appears likely that a much closer relationship would be found if a more reliable and valid measure of extraversion were to be used and if a more reliable method of determining reminiscence could be devised. Experiments along these lines have indicated that shorter periods of practice (60 to 90 seconds) might give better results than the rather longer period employed in the present experiment.

Some discussion, however, appears to be necessary on the relationship between reminiscence and neuroticism. An explanation may be found along the following lines. First of all, it may be postulated with Mowrer (27), Dollard and Miller (4), Spence and Taylor (31, 32, 33), and other learning theorists that neuroticism is essentially an (autonomic) drive variable. The term usually chosen to identify this characteristic is, of course, *anxiety*. However, this term often implies not only what is psychiatrically known as anxiety state, but the whole group of neurotic disorders, so that "anxiety" and "neuroticism" are used interchangeably. This correspondence has been demonstrated by Franks (17), who found a correlation of .92 between the Maudsley Medical Questionnaire, a widely used measure of neuroticism (8), and the Taylor Anxiety Scale, a scale employed by Spence and his associates as an operational definition of anxiety. Hysterics are supposed to be psychiatrically differentiated from anxiety states in that they show relatively little anxiety. Yet hysterical Ss had scores on the Taylor Anxiety Scale intermediate between those of a group of anxiety patients and a group of normals (17). Consequently, it may be clarifying to talk about neuroticism as the major variable characterizing all neurotic groups, and to use the term anxiety to characterize the introverted neurotic group. There is ample evidence to justify this usage (9).

The relevance of drive (in this case autonomic drive, or neuroticism) to reminiscence follows from an extension of the Hullian theory made by Kimble (22). According to him, the amount of reactive inhibition which *S* will tolerate in a motor-learning situation is in part a function of his drive; "the greater amount of this motivation the greater amount of  $I_R$  he will tolerate" (p. 248). Kimble explains that this hypothesis follows from the fact that reactive inhibition is thought of as a negative drive or as a need to rest.

As such it acts in opposition to the needs leading to the continuation of practice. If we adopt the position that a given amount of  $I_R$  cancels a certain amount of these more positive needs, then it follows that the highly motivated *S* will continue to practice in spite of the presence of an amount of inhibition which would produce a cessation of activity in a less highly activated *S*. *The experimental prediction to which this argument leads is that the amount of reminiscence . . . will increase with an increase in motivation* (p. 248).

Both Kimble himself (22) and Wasserman (34) have provided experimental evidence in favor of this hypothesis, which may, therefore, be regarded as essentially substantiated.

The linkage of this hypothesis within learning theory to personality study is as follows. If one regards neuroticism as a drive, and if drive leads to an increase in the amount of  $I_R$  tolerated by the organism before producing a cessation of activity, then individuals with strong drives should produce greater amounts of  $I_R$  and consequently higher reminiscence scores. As this is precisely what is empirically found, one may regard this explanation as quite feasible. It would be interesting to know whether neurotics as compared with normals have higher reminiscence scores. A prediction to this effect would seem to follow from Kimble's theory and the results here reported. However, the situation may be more complicated because the drive in this connection would presumably have to be a relevant one, and it would be rather more difficult to ensure an equal relevance of autonomic drive as between hospitalized neurotics and nonhospitalized normals than it would be between Ss having high and low neuroticism scores respectively as in this study.

Among neurotics, one is probably on safe ground in predicting that hysterics and psychopaths will have higher reminiscence scores than anxiety states and reactive depressives (dysthymics). In terms of the MMPI and the use made of the *Hy-Pt* score devised by Eriksen (5, 6) one would probably also be correct in predicting that this score would correlate positively with reminiscence in both neurotics and normals. Thus, putting the various groups in order of expected reminiscence-score size, one has hysterics and psychopaths, followed by normal extraverts and dysthymics, with normal introverts last. It is impossible to predict with any confidence the relative positions of normal extraverts and of dysthymics; such a prediction would require a more precise knowledge of the exact degree of relationship obtaining between  $I_R$  and neuroticism and extraversion, respectively.

#### SUMMARY

This paper reports an experiment performed to test the hypothesis derived from learning theory, that *reminiscence on the pursuit rotor*

following massed practice should be greater for extraverts than for introverts. The relationship between reminiscence and neuroticism was also investigated. Fifty university students were employed as subjects, using pursuit-rotor learning as a measure of reminiscence and the Maudsley Personality Inventory as a measure of extraversion-introversion and neuroticism. Extraversion was found to be associated with reminiscence, according to hypothesis, and reminiscence was also found to be significantly greater for subjects high in neuroticism than for subjects low in neuroticism. These results are interpreted as indicating the fruitfulness of linking personality study with learning theory (11).

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