

THE POSITION OF HYSTERICIS AND DYSTHYMICS IN A TWO-DIMENSIONAL FRAMEWORK OF PERSONALITY DESCRIPTION

H. J. EYSENCK AND G. CLARIDGE¹

Institute of Psychiatry, Maudsley Hospital, University of London

The present authors have always maintained that psychiatric classification in terms of diagnostic labels is not an adequate method of description (Claridge, 1960; Eysenck, 1947, 1952) and that much of the well known unreliability of diagnosis in psychiatry derives from the acceptance in this field of medical practices which are not well suited to the problems at issue (Eysenck, 1960b). Instead, Eysenck has proposed a description in terms of a dimensional framework derived from empirical studies, by means of appropriate statistical techniques—factor analysis and multiple discrimination analysis (Eysenck, 1957). He has also suggested that it was to be expected that groups of psychiatric subjects bearing the same diagnostic label would be found relatively close together in the *n*-dimensional framework resulting from the execution of such a scheme as that proposed; the degree of correspondence between categorical-diagnostic and continuous-dimensional framework would of course depend largely on (*a*) the reliability of psychiatric diagnosis (which could be increased by only choosing subjects where there was considerable agreement among psychiatrists as to diagnosis), and (*b*) the adequacy of the objective tests chosen to measure the subjects position in the dimensional framework.

In the field of neurotic disorders, the evidence seemed to suggest (*a*) that two main factors at least were required to account for the personality differences between subjects belonging to different psychiatric categories, viz., those of *neuroticism* and *extraversion-*

introversion; (*b*) that subjects labeled “hysterics” and “psychopaths” had high scores on neuroticism and extraversion, while subjects labeled “anxiety states,” “reactive depressions,” or phobic, compulsive, and obsessional patients had high scores on introversion and neuroticism. (This introverted neurotic group was called “dysthymics.”) Mixed neurotics were supposed to be intermediate with respect to extraversion-introversion, but of course also high on neuroticism. This theory goes back to Janet and Jung in its main form, although the precise connotation given to the terms has almost certainly changed to some extent in the intervening years (cf. Eysenck, 1960d, for a historical survey of the development of the concept of extraversion-introversion, and for a review of the experimental literature).

Lately, a questionnaire has been published, called the Maudsley Personality Inventory or MPI (Eysenck, 1959), which purports to measure neuroticism and extraversion-introversion with sufficient reliability (both split-half and repeat are between .8 and .9) to serve as criterion scores when the more laborious measurements of these dimensions of personality by means of a battery of objective tests is not feasible. In normal populations these two scales are independent, or very nearly so, and much evidence has accumulated to show that predictions made on the basis of Eysenck's (1957) dynamic theory of personality can often be verified by having recourse to this questionnaire (Eysenck, 1960a). Use with neurotic groups, however, has been less successful. It has usually been found (Eysenck, 1959; Sigal, Star, & Franks, 1958) that the two scales do not retain their orthogonality but correlate together to an appreciable extent ($r_{EN} = -.45$ approximately); that hysterics have lower neuroti-

¹We are indebted to the United States Army, under whose grant, No. DA-91-508-EUC-311, this investigation was carried out. We wish to acknowledge the cooperation of J. McGhie, Commanding Officer at the Royal Victoria Hospital, Netley, and of R. L. Herrington, who assisted in connection with the determination of the sedation thresholds.

cism scores than do dysthymics; and that hysterics not only fail to be more extraverted than normals but may actually have slightly more introverted scores. (Psychopaths tend to behave as predicted, having high neuroticism and extraversion scores.) The results perturbed Sigal et al. (1958) to such an extent that they concluded: "The results suggest that either hysterics and dysthymics cannot be used in the described manner [i.e., as criterion groups for extraversion-introversion], or that the E and N scales do not measure introversion-extraversion and neuroticism, or that both statements are true" (p. 147). In a reply, Eysenck (1958) pointed out some errors in the arguments presented, but there is no doubt that the facts as given have been duplicated in several successive investigations (Eysenck, 1959) and that we are faced with a choice between two possibilities. Either we must give up the notion that hysterics are more extraverted than normals, as well as being more neurotic, or we must seek for some distorting factors in the MPI which account for the anomalous results in comparing normal and neurotic groups (Eysenck, 1958, p. 251). Clearly a recourse to experiment rather than to argument is called for.

The type of experiment required is one in which the three groups in question (normals, dysthymics, hysterics) are administered a battery of objective tests, differentiating between these three groups. The results could then be treated along either or both of the following lines:

A factor analysis could be performed which should give two factors identifiable as neuroticism and extraversion-introversion; factor scores would then be estimated for each subject, and these should discriminate the members of the three groups in such a way that hysterics should have the highest extraversion scores, dysthymics the lowest, while both groups should have higher neuroticism scores than the normals.

A multiple discriminant function (canonical variate) type of analysis could be performed which should give rise to two significant latent roots, identifiable as neuroticism and extraversion-introversion; canonical variate scores could then be obtained by using the latent

vectors as weights and multiplying them by the scores on the tests. These scores should then discriminate the members of the three groups in the same way as the factor scores.

A study fulfilling some of these requirements has been reported by Eysenck, Eysenck, and Claridge (1960), except that they concentrated on tests of extraversion almost exclusively, and did not obtain significant discrimination between neurotic and normal groups. Both a factorial analysis and an analysis of discriminance was performed, and on both hysterics emerged as the most extraverted and dysthymics as the most introverted group (the scores derived from the two analyses correlated to the extent of .81). The present study was carried out to give a more extensive and definite answer to the problem by attempting to use tests which would measure neuroticism as well as extraversion-introversion.

METHOD

Subjects

Neurotic subjects at the Royal Victoria Hospital were selected on admission where the psychiatrists in charge of the case could make a definite diagnosis of anxiety state or hysteria. One psychiatrist's diagnosis was sufficient to admit the patient to the experimental group. The subjects selected were not extreme or "pure" cases, but were chosen by the psychiatrist on the assumption that there would be a good consensus of opinion among psychiatrists regarding the diagnosis. Of the available cases not excluded for reasons given below, less than a third were excluded as presenting too mixed or complex a psychopathology to attempt a ready classification. Cases of immaturity were not included, and patients with evidence of brain damage, psychotic involvement, or drug addiction of any kind (including alcohol) were rejected. In each group there were 14 male and 2 female patients. The normal control group consisted of 16 volunteers, of whom 15 were male and 1 female. All were engaged on various duties in the hospital, including that of nursing orderly, clerk, storeman, and laboratory technician. The mean ages of the three groups were: dysthymics = 27.91, normals = 23.67, and hysterics = 23.78. The dysthymics were significantly older than the other two groups, with an F of 3.239. On weight and intelligence, as measured on Progressive Matrices, there were no significant differences.

Tests

Sedation threshold. This was assessed in terms of the effect of sodium amytal on a simple task, consisting of doubling the digits read out to the

subject at intervals of 2 seconds from a tape recording of random digits over earphones, while he was receiving a continuous intravenous infusion of the drug at the rate of 0.1 g/min. Errors were recorded in blocks of five trials, and the threshold was taken as the point midway between the last two blocks with less than 50% errors and the first two blocks in which errors exceeded 50%. In the majority of cases these blocks were consecutive. The amount of drug administered at this point was determined from a chart relating blocks of trials to drug received, and this dosage was then corrected for the weight of the patient, giving the threshold in terms of mgm/Kg.²

Maudsley Personality Inventory. The two scales of the MPI were included in the experiment because their inclusion would, if anything, work against the hypothesis under investigation; furthermore, it was considered worth while discovering whether the neurotic groups in this study behaved similarly to those in previous ones.

Five-choice serial reaction task. The subject was required to press one of five keys set in front of five lights, according to which of the lights went on; his response extinguished the light and switched on another one. The order of the lights was random over a series of 50, except that no light appeared twice in succession. The score taken was the number of responses for each minute of the work period. Ten minutes of continuous performance was followed by a rest of 5 minutes and a further period of practice of 1 minute.

The usual pattern of performance shown by most subjects on this test (Venables, 1959) is a gradual decline in performance level during the first 5 minutes, then an increase in speed during the second 5 minutes of practice. Following the rest the usual reminiscence effect appears, in the form of an abrupt rise in performance level. The measures here taken are starting level and total number of errors.²

Spiral aftereffects. The subject is asked to fixate a rotating single-throw 180-degree spiral, and to indicate the duration of the aftereffect. Four trials were given, the spiral being rotated for one minute each time; trials were alternately clockwise and counterclockwise, with a rest of one minute between trials. The means of the four scores thus obtained were taken as a measure of the subject's performance on this task.

Predictions

The predictions made follow from Eysenck's (1957, 1960a) theory, according to which cortical inhibition is hypothesized to be generated more quickly and more strongly, and dissipated more slowly in extraverts than in introverts; they are, in

brief, that extraverts would have *low* sedation thresholds, *high* scores on the E scale of the MPI, *low* starting level and *high* number of errors on the reaction time task, and *short* spiral aftereffects. Predictions with respect to neuroticism are much less obvious, except with regard to the N scale of the MPI; in view of the repeated observation that in neurotic groups N correlates negatively with E we might also expect E to have a negative loading with neuroticism *in this population*. Poor performance on sensory-motor tasks appears to characterize neurotics (Easterbrook, 1958; Eysenck, 1952; Eysenck, Granger, & Brengelmann, 1957) so we might expect the error score to load positively and the starting level score to load negatively on neuroticism. Predictions with respect to the sedation threshold cannot be made with any confidence. Shagass and his colleagues (as quoted by Claridge & Herrington, 1961, in their discussion of this problem) report high thresholds as characteristic of "anxiety," but this is a two-valued concept having loadings on both introversion and neuroticism. We have predicted high thresholds in introverts; this leaves the loading of the threshold on neuroticism indeterminate.

RESULTS

These six sets of scores had been decided upon from the beginning as constituting the material for analysis. In addition, the Manifest Anxiety (*MA*) scale was administered, but not included in the analysis. Mean scores for the six tests and the *MA* scale are given in Table 1, together with *SDs* and *F* ratios. It will be seen that with the exception of the Five Choice Test Error Score all tests discriminate significantly; it will also be seen that scores on the E scale put the hysterics well to the introverted side of the normals, thus exaggerating the fault found by Sigal et al. (1958). Scores on the sedation threshold level, the spiral aftereffect, and the Error and Starting Level of the five choice test, however, put the hysterics on the *extraverted* side of the normal group. We find here the first signs that no single test can be relied upon to decide upon the correct position of groups such as these relative to each other, but that multiple determination is required. The *MA* scale, as expected, shows highest scores for the dysthymic group, and lowest scores for the normals; this was predicted (Eysenck, 1957) on the basis that the *MA* scale is essentially a measure of neuroticism with an admixture of introversion, i.e., that it is specifically aimed at the dysthymic group.

² For a detailed discussion of the rationale and method of use of the sedation threshold and five-choice serial reaction task, cf. Claridge and Herrington (1961), Claridge (1961), and Venables (1959).

TABLE 1
MEAN SCORES OF DYSTHYMICS, NORMALS, AND HYSTERICIS

Test	Dysthymics	Normals	Hysterics	F
Sedation threshold	10.18 ± 1.608	7.86 ± 1.313	6.43 ± 1.774	21.837***
E scale	18.31 ± 8.169	31.50 ± 7.575	24.62 ± 8.366	10.120***
N scale	36.62 ± 7.631	19.12 ± 8.392	31.19 ± 11.092	14.354***
Spiral aftereffect	18.79 ± 5.093	11.41 ± 4.125	8.85 ± 3.167	22.576***
Five choice test, starting level	90.14 ± 15.412	82.34 ± 11.331	77.51 ± 12.499	3.530*
Errors	11.12 ± 10.705	8.63 ± 8.748	19.88 ± 20.524	2.563 ^a
MA scale	17.00 ± 3.774	6.25 ± 3.699	13.69 ± 5.860	21.903***

^a ns = not significant at the $p = .05$ level.

* Significant at the $p = .05$ level.

** Significant at the $p = .01$ level.

*** Significant at the $p = .001$ level.

Multiple discriminant function analysis.³

Table 2 shows the latent vectors and the latent roots extracted from our set of six tests; both latent roots are fully significant at the .001 level of p . The first variate accounts for 60.99% of the variance, the second one for 39.02%. Mean variate scores are given in Table 3, and the actual positions of the 16 subjects in each of the three groups plotted against the two variates are shown in Figure 1. Lines drawn in the body of the figure at values of 22 for Variate 1 and 12.2 for Variate 2 show that Variate 1 completely and without overlap discriminates between hysterics and dysthymics; this variate may therefore be identified with extraversion-introversion. Variate 2 discriminates slightly less well between normals and neurotics; three members of each group are misclassified. It must of course be

³ We are indebted to P. Slater and A. E. Maxwell for their advice and discussion of the statistical issues raised in this paper. We are also indebted to B. Nixon for supervising the processing of the data through the University of London electronic computer, and to N. Hemsley for carrying out some of the calculations.

TABLE 2
LATENT FACTORS AND LATENT ROOTS

	λ_1	λ_2
Sedation threshold	1.0000000	1.0000000
E score	-.0519939	.261961
N score	.0429769	-.354949
Spiral aftereffect	.505898	.158374
Starting level	.0657491	-.073380
Errors	.0156142	.0496781

$\lambda_1 = .732548$ $p < .001$.

$\lambda_2 = .468676$ $p < .001$.

remembered that the criterion here is less satisfactory than in the case of the hysteric-dysthymic dichotomy, where psychiatric diagnosis of a clear-cut kind was obtained. The normal subjects in this experiment were normal only in the sense of not, at the time, being under psychiatric care; as Fraser (1947) and Shepherd, Fisher, Stein, and Kessel (1959) have shown, such groups nevertheless contain some 10% of fairly definite neurotics. In spite of our failure to obtain perfect discrimination, therefore, we may perhaps be justified in identifying Variate 2 with neuroticism.

The mean positions of the three groups are shown in Figure 1 in addition to the positions of the individual subjects, and it will be seen that hysterics lie on the opposite (extraverted) side of the normals, as compared with the dysthymics who lie on the introverted side. Furthermore, the hysterics appear if anything more neurotic than do the dysthymics. These results support the original theory regarding the respective positions of the three groups. It should be noted in this connection that our normal sample was conspicuously more extraverted than would be likely to be found in an unselected group; these Army volunteers

TABLE 3
MEAN VARIATE SCORES

	λ_1	λ_2
Dysthymics	26.60	8.67
Normals	18.37	14.59
Hysterics	16.50	5.69
	(Extraversion)	(Neuroticism)

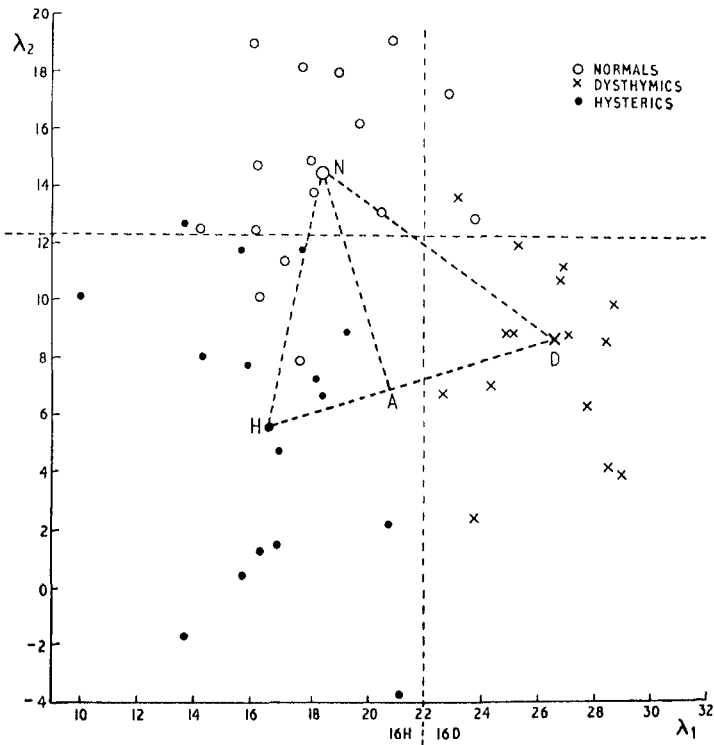


FIG. 1. Position of 16 normals, 16 dysthymics, and 16 hysterics in two-dimensional space as determined by analysis of discriminance.

had an E score of 31.50, as compared with the population norms of 24.91 given by Eysenck (1959). A similar tendency for Army volunteers to have exceptionally high extraversion scores had been noted in connection with a previous study (Eysenck, 1960a; Hildebrand, 1958). It is possible that this high degree of extraversion was due to the fact that the experimental subjects were volunteers; there is some evidence to suggest that extraverts are more likely to volunteer for experiments of this type. This might account for the fact that while the hysterics are more extraverted than the normals, the difference on this dimension between hysterics and normals is in fact much less than between normals and dysthymics.

An alternative hypothesis to account for this fact, as well as the rather curious finding that the hysterics emerged as more neurotic even than the dysthymics, may be derived from the fact that the canonical variates as extracted from the data depend to some extent

on the precise tests used, and are not likely to be collinear with the "true" variates which would be extracted from an infinite series of relevant tests. It is thus possible that the line H-D drawn in Figure 1 might be a better approximation to the "true" extraversion-introversion dimension, while the line N-A would then be an improved approximation to the "true" neuroticism dimension. The change would be minimal, and the number of misplacements would not be affected; yet hysterics and dysthymics would be equidistant from the normals, in opposite direction, along the extra-introversion dimension, and also equidistant from the normals, in the same direction along the neuroticism dimension. Further research along these lines, with a better selection of normals, and a greater number of tests, would be required to decide between these hypotheses. Whatever the final verdict, the fact remains that as predicted two highly significant latent roots have emerged from our analysis, thus indicating that two

TABLE 4
FACTOR LOADINGS

	1	2	3	2'	3'
Sedation threshold	.81	-.27	.29	+.39	+.05
E	-.63	-.36	.33	+.48	+.11
N	.61	.19	-.40	-.44	+.07
Starting level	.37	.54	.73	+.29	-.86
Error	-.27	.86	-.15	-.62	-.62
Spiral	.72	-.13	-.14	-.04	+.19

dimensions are required to account for the differences between the three groups studied, and that in this two-dimensional space the three groups are disposed in the form of an (almost exactly) equilateral triangle. The hypothesis that hysterics and dysthymics are, respectively, extraverted and introverted neurotics has thus been confirmed by this analysis.

Factor analysis. Product-moment correlations were calculated between the six scores for the 48 subjects, and a Hotelling principal components factor analysis performed; all six factors were extracted, and the analysis was carried out with three digits retained after the decimal point.⁴ Table 4 shows the unrotated factor loadings of the first three factors. Inspection of the plot of Factors 2 and 3 indicated clearly that a rotation in line with Thurstone's principle of simple structure would sort out Factor 3 as a doublet loading on nothing but the two scores derived from the reaction time test, and therefore probably simply an artifact. Accordingly the rotation was performed, and Factors 2' and 3' are shown in the table. Following a policy of minimum rotation, which seemed advisable as it gives least room for subjective judgment or arbitrary statistical rules, no further rotations were carried out, and Factors 1 and 2' are shown in Figure 2. Factor 1 can clearly

⁴ There must be some doubt about the advisability of calculating product-moment correlations on a combined set of scores derived from three groups hypothetically situated at different points of a two-dimensional space. Strictly speaking this is not permissible if the hypothesis is in fact true, but the distributions are sufficiently normal, and the overlap sufficiently large, to make it not completely out of the question that the results might have a modicum of meaning.

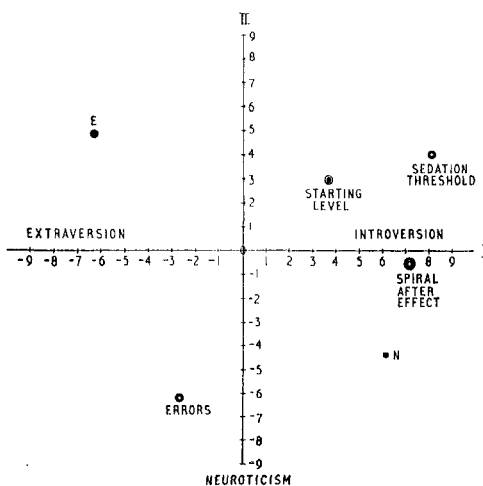


FIG. 2. Position of six tests in two-dimensional factor space.

be identified as introversion-extraversion, all the tests having the predicted loadings on it (sedation threshold, starting level, and spiral aftereffect are positive, E and errors negative). Factor 2 can be identified with neuroticism provided we are willing to accept the very tentative predictions made above.

The validity of both these interpretations can be tested by calculating factor scores for the members of our three groups; if the identification is correct, then these should fall into a pattern identical with that shown in Figure 1. Figure 3 shows the result of such an analysis, and the similarity with Figure 1 will be apparent. Such inspection is instructive, but a more quantitative estimate may be preferred. Factor 1 and Canonical Variate 1 correlate to the extent of .94; Factor 2 and Canonical Variate 2 correlate to the extent of .88. These correlations are high enough to give us some confidence in the identity of the two analyses, and in the accuracy of our factor identification. The cross-correlations, i.e., Factor 1 with Variate 2, and Factor 2 with Variate 1, are statistically insignificant.

As in Figure 1, so here also the baseline of the triangle produced by joining the mean positions of the three groups is not parallel with the horizontal axis, but inclined down towards the left; it follows that a slightly better discrimination might have been achieved by some further rotations. With the small

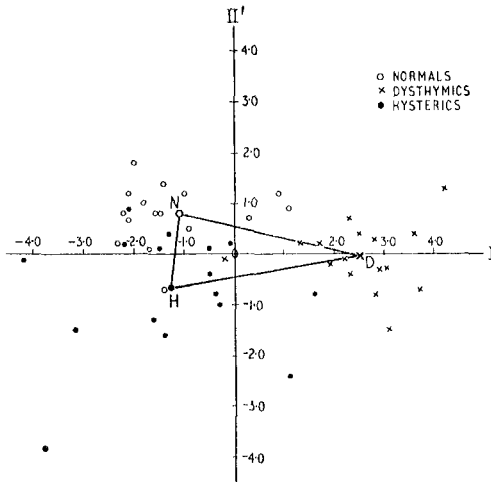


FIG. 3. Position of 16 normals, 16 dysthymics, and 16 hysterics in two-dimensional space as determined by factor analysis.

number of cases employed there seemed to be no point in further analysis, but it should be noted that here also, as before, the hysterics have higher scores on neuroticism than the dysthymics. As in the previous analysis, the hysterics are more extraverted than the normals, but only very slightly so; rotation to make the line linking the mean positions of dysthymics and hysterics collinear with the horizontal axis would increase this separation.

It might appear a task of supererogation to compare the results of these two methods of analysis (factor analysis and multiple discriminant function analysis) when it might be thought on a priori grounds that similarity would be the expected outcome. A mathematical and empirical investigation of the matter by Slater (1960) shows that this is not so, "Very little theoretical justification has been found here for expecting the vectors defined by a factor analysis to coincide with those defined by a discriminatory analysis of the same data; and the evidence examined has shown that they do not converge closely even under particularly favourable conditions." The data examined by Slater were those gathered by Hildebrand (1958) in one of the earliest factorial studies of the two-dimensional hypothesis under discussion (the data were collected in 1952); nothing can illustrate the improvement in the choice of tests for

the measurement of introversion-extraversion since those days better than the almost perfect congruence achieved in the present study, as compared with the failure to do so in the previous one. This improvement is likely to be due to the general theory advanced recently and purporting to give a rational basis to this dimension of personality (Eysenck, 1957), and conversely this success of the tests selected on the basis of the theory must give some support to the postulates of this theory.

DISCUSSION

The results of this analysis make it clear that hysterics and dysthymics, respectively, may indeed with advantage be used as criterion groups of the personality dimension of extraversion-introversion. It remains doubtful whether the hysteric group is as much more extraverted than the normal group, as is the dysthymic group more introverted than the normal group. It is likely that the proper counterpart of the dysthymic group is a combination of hysterics and psychopaths, with the psychopaths somewhat more extraverted than the hysterics; their omission from the group of supposedly extraverted neurotics may be responsible for the appearance of this doubt. No doubt remains about the degree of neuroticism of the hysteric group; in both analyses they had the highest scores on this dimension.

With respect to the MPI, the results leave little doubt, as had indeed been pointed out in the manual (Eysenck, 1959), that the E and N scales do not retain their independence when neurotic samples are being tested, or even normal samples with high neuroticism scores. Even under these conditions, dysthymics still obtain scores which put them at a much more introverted part of the continuum than the hysterics, and the scales, therefore, retain some of their usefulness even when the level of neuroticism is high. However, comparisons involving both normal and neurotic groups become hazardous, and wrong conclusions may be drawn unless these essential cautions are borne in mind. Furthermore, in spite of their high degree of neuroticism as established by objective tests, hysterics have

lower scores on the N scale than do dysthymics; this point also requires caution in interpretation.

If these considerations only affected the MPI, it might be possible to brush the findings aside by refusing to use the test in question; this can hardly be said to resolve the problem, however, in view of the fact that in factorial studies considerable correlations have been found between the MPI on the one hand, and on the other, Cattell's second-order factors of extraversion and neuroticism, Guilford's various primary factor scales, the Taylor *MA* scale, and also some of the MMPI scales, notably the Hysteria, Psychopathy, and Psychasthenia scales (Eysenck, 1960a). What is true of the MPI, therefore, is *eo ipso* likely to be true of these other scales too, and the Hildebrand (1958) study, which used a large number of different types of questionnaires, may be interpreted to support this position. Refusal to use the MPI, therefore, should entail logically the refusal to use any questionnaire, at least until this problem had been thoroughly investigated. Until this has been done, it would appear more reasonable to use these scales as before but bear in mind in the interpretation of results the nonlinearity of regression lines as the region of high neuroticism and high introversion is approached.

Several hypotheses suggest themselves for experimental examination.

The hypothesis of response sets being responsible for the phenomenon cannot be ruled out, although some preliminary data speak against it (Eysenck, 1962). It is difficult to put such an hypothesis in a rigorous form, but this general field of investigation would almost certainly repay study.

The hypothesis of genuine interaction effects between introversion and neuroticism should not be disregarded. There may be a point in the conditionability, which according to theory characterizes the introvert, where fear responses are acquired at a rate and at a strength which exceeds the strength of the normal extinction processes; this point may delimit a region of positive feedback which could be responsible for the interaction. (Something of this kind is actually postulated by Wolpe, 1958, pp. 63-64, as an ex-

planation of the effectiveness of mild shock in learning neurotic responses.)

There may be a concentration on dysthymic symptoms in the construction of the N scale, and similar questionnaires, which leads to the omission of the main hysterical and psychopathic symptoms—possibly because these are difficult to elicit in a questionnaire (Eysenck, 1947). Milder forms of hysterical and psychopathic disorder might be more similar to those of dysthymics, thus making this problem urgent only at high levels of neuroticism. The *Hy* and *Pd* scales of the MMPI have not succeeded in overcoming this difficulty; in administering them to groups of hysterics, psychopaths, and dysthymics we have found no significant or even suggestive relationship with diagnosis, even when the E scale did show reasonable discrimination (Eysenck, 1962). With normals these scales also tend to work rather better (Eysenck, 1960a).

It has been shown that there is no unitary trait of *sociability*, but that of the items collected into that factor by Guilford (Factor S) approximately half correlate with extraversion, but not with neuroticism, while the others correlate with neuroticism (negatively), but not with extraversion (Eysenck, 1956). Thus there are two sorts of social shyness: introverted ("don't like being with people, but don't mind if I have to") and neurotic ("would like to be with people, but am afraid"). In view of the large part questions on *sociability* play in the E scale, it is possible that at high levels of introversion this distinction breaks down to some extent, thus causing the sudden break in linearity.

Perhaps the most likely reason for the correlation between introversion and neuroticism among high scoring subjects is one which can be deduced from the general theory of extraversion, according to which cortical inhibition is stronger in extraverts than in introverts. This principle applies to all sensory inputs, proprioceptive as well as exteroceptive; it seems likely therefore that the perception of the autonomic activity characteristic of emotion is equally subject to such inhibition. Now strong and lasting autonomic reactions are of course characteristic of neurotics (and quite generally of individuals with high scores on the N scale). We would expect therefore that

in comparing introverted and extraverted neurotics the autonomic reactions of the latter, while equally strong to begin with, would soon be subject to strong inhibitory forces and thus go down to a much lower level as compared with the reactions of introverts. Now the questionnaire items relating to neuroticism tend to refer in the main to long continued autonomic reactions or their consequences, and these in terms of our theory would be expected to be more marked in introverts than in extraverts. This hypothesis, like the others mentioned, is of course susceptible to experimental proof; it seems to involve no *ad hoc* assumptions which cannot be deduced from our general theory and it seems capable of resolving the problem raised by Sigal et al. (1958).

From a more fundamental point of view, it might be argued that the terms "extraversion" and "introversion" have been used rather misleadingly in two different senses. According to Eysenck's (1957) theory, certain innate physiological properties of the central nervous system (the excitation-inhibition balance) lie at the basis of observable extraverted and introverted behavior patterns. The term "extravert" may be applied (*a*) to a person in whom the excitation-inhibition balance is tilted in the direction of high inhibition and low excitation (the *constitutional* extravert), or (*b*) it may be used to refer to the person who is behaving in an extraverted manner (*a behavioral* extravert). As explained in detail elsewhere (Eysenck, 1960c) the theory posits a positive relationship between constitution and behavior, but this relationship is not likely to be perfect. Environmental differences clearly will play an important role in determining the way in which constitutional factors express themselves. Thus it is possible, although unlikely, that a *constitutional* extravert may turn out to be a *behavioral* introvert, or a dysthymic neurotic (Foulds, 1959; Foulds & Caine, 1958).

Certain factors may have contradictory effects on these two variables; thus old age probably alters the *constitutional* balance in the direction of greater *extraversion* and the *behavioral* balance in the direction of greater *introversion*. It is not impossible that neurosis,

whilst leaving the constitutional basis unaffected, shifts the behavioral basis in the direction of greater introversion. To take but one example, normal extraverts are more sociable than normal introverts. It is not inconceivable that the presence of severe neurotic symptoms (whether of a hysterical or dysthymic type) may interfere with social intercourse, thus shifting the behavioral balance towards greater introversion in both extraverts and introverts. Questionnaires such as the MPI are sensitive measures of *behavioral* extraversion; objective tests such as those used in this experiment are probably sensitive measures of *constitutional* extraversion. Factorial studies such as those of Claridge (1960), and the one reported here, show that constitutional and behavioral measures are not unrelated, but it would be a mistake not to distinguish in principle between them. The interesting question arises therefore whether hysteria and dysthymia are more closely related to constitutional or behavioral extraversion; the present results suggest the former. If true, this would mean that from the point of view of testing some of the experimental predictions from Eysenck's inhibition-satiation theory of personality, hysterics and dysthymics as criterion groups would be preferable to normal criterion groups selected on the basis of the MPI, although the latter test would come into its own in the testing of predictions relating the constitutional and behavioral aspects of personality to each other.

SUMMARY

The results are reported of testing 16 normals, 16 hysterics, and 16 dysthymics by means of objective laboratory tests and questionnaires, and analysing the scores by means of multiple discriminant analysis and factor analysis. Both methods give rise to two main principles of classification, or dimensions of personality, which can be identified as extraversion-introversion and neuroticism, respectively; high correlations are found between the respective methods of ordering the 48 subjects along the two continua. Hysterics were found to be extraverted and neurotic, dysthymics were found to be introverted and neurotic; perfect discrimination was achieved

between hysterics and dysthymics, and reasonable discrimination between neurotics and normals. Analysis of the questionnaire scores verified previous results in showing a departure from linearity of regression at high levels of introversion and neuroticism scores. The implications of these findings are discussed in relation to the use of hysterics and dysthymics as criterion groups for the study of personality dimensions.

REFERENCES

- CLARIDGE, G. The excitation-inhibition balance in neurotics. In H. J. Eysenck (Ed.), *Experiments in personality*. Vol. 2. London: Routledge & Kegan Paul, 1960. Pp. 107-154.
- CLARIDGE, G. The effects of meprobamate on the performance of a five-choice serial reaction time task. 1961, in press.
- CLARIDGE, G., & HERRINGTON, R. N. Sedation threshold, personality, and the theory of neurosis. *J. ment. Sci.*, 1961, in press.
- EASTERBROOK, J. A. The effect of emotion on cue utilization and the organization of behavior. *Psychol. Rev.*, 1958, **66**, 183-201.
- EYSENCK, H. J. *Dimensions of personality*. London: Routledge & Kegan Paul, 1947.
- EYSENCK, H. J. *The scientific study of personality*. London: Routledge & Kegan Paul, 1952.
- EYSENCK, H. J. The questionnaire measurement of neuroticism and extraversion. *Riv. Psicol.*, 1956, **50**, 113-140.
- EYSENCK, H. J. *The dynamics of anxiety and hysteria*. London: Routledge & Kegan Paul, 1957.
- EYSENCK, H. J. Hysterics and dysthymics as criterion groups in the study of introversion-extraversion: A reply. *J. abnorm. soc. Psychol.*, 1958, **57**, 250-252.
- EYSENCK, H. J. *Manual of the Maudsley Personality Inventory*. London: Univer. London Press, 1959.
- EYSENCK, H. J. *Experiments in personality*. London: Routledge & Kegan Paul, 1960. (a)
- EYSENCK, H. J. (Ed.) *Handbook of abnormal psychology*. London: Pitman, 1960. (b)
- EYSENCK, H. J. Levels of personality, constitutional factors, and social influences: An experimental approach. *Int. J. soc. Psychiat.*, 1960, **6**, 12-24. (c)
- EYSENCK, H. J. *The structure of human personality*. London: Methuen, 1960. (d)
- EYSENCK, H. J. Response set, authoritarianism and personality questionnaires. *Brit. J. soc. abnorm. Psychol.*, 1962, in press.
- EYSENCK, H. J., GRANGER, G., & BRENGELMANN, H. *Perceptual processes and mental illness*. London: Chapman & Hall, 1957.
- EYSENCK, S. B. G., EYSENCK, H. J., & CLARIDGE, G. Dimension of personality, psychiatric syndromes, and mathematical models. *J. ment. Sci.*, 1960, **106**, 581-589.
- FOULDS, G. A. The relative stability of personality measures compared with diagnostic measures. *J. ment. Sci.*, 1959, **105**, 783-787.
- FOULDS, G. A., & CAINE, T. M. Psychoneurotic symptom clusters, trait clusters and psychological tests. *J. ment. Sci.*, 1958, **104**, 722-731.
- FRASER, R. *The incidence of neurosis among factory workers*. London: HM Stationery Office, 1947.
- HILDEBRAND, H. P. A factorial study of introversion-extraversion. *Brit. J. Psychol.*, 1958, **49**, 1-12.
- SHEPHERD, M., FISHER, M., STEIN, L., & KESSEL, W. I. N. Psychiatric morbidity in an urban group practice. *Proc. Roy. Soc. Med.*, 1959, **52**, 269-274.
- SIGAL, J. J., STAR, K. H., & FRANKS, C. M. Hysterics and dysthymics as criterion groups in the study of introversion-extraversion. *J. abnorm. soc. Psychol.*, 1958, **57**, 143-148.
- SLATER, P. Experiments in psychometrics. In H. J. Eysenck (Ed.), *Experiments in personality*. Vol. 2. London: Routledge & Kegan Paul, 1960. Pp. 247-299.
- VENABLES, P. H. Factors in the motor behavior of functional psychotics. *J. abnorm. soc. psychol.*, 1959, **58**, 153-156.
- WOLPE, J. *Psychotherapy by reciprocal inhibition*. Palo Alto: Stanford Univer. Press, 1958.

(Received January 4, 1961)