scores. He found no significant difference between his high anxious and low anxious *S*s.

When the results of the present study are taken together with Taffel's and Daily's, two conclusions seem tenable:

1. There is a relationship between Taylor MAS scores and verbal conditioning, but it holds only for a selected population of Veterans Administration male psychiatric inpatients.

2. There is no relationship between MAS scores and verbal conditioning, and Taffel's positive finding may be attributed to random fluctuations in sampling.

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HYSTERICS AND DYSTHYMICS AS CRITERION GROUPS IN THE STUDY OF INTROVERSION-EXTRAVERSION: A REPLY

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IN THEIR interesting study of the validity of the Maudsley Personality Inventory, Sigal, Star, and Franks (3) come to an incorrect conclusion because of several logical errors which deserve brief discussion.

The hypothesis underlying the use of hysterics, psychopaths, and dysthymics as criterion groups for extraversion-introversion derives, of course, from Jung, not, as Sigal et al. state, from myself. Jung maintains "that much the most frequent neurotic disorder of the extraverted type is hysteria"; on the other hand, speaking of the introvert, he maintains that "his typical neurotic disorder is psychasthenia," or, as I would prefer to call it, dysthymia. Two consequences would seem to follow from this hypothesis. In the first place, among neurotics, those of a dysthymic pathology should be more introverted than those of a hysteric or psychopathic pathology. (What is now called "psychopathy" is traditionally considered as part of the complex of disorders diagnosed as "hysteria"; I have documented this statement in [2, ch. 6].) This is the crucial deduction on which hinges the usefulness of these nosological groups for the purpose of questionnaire validation.[1] The second deduction to be made from Jung's hypothesis is that normal groups should be intermediate between the hysteric and psychopathic groups on the one hand, and the dysthymic groups on the other. The truth or falsity of the second proposition, while of considerable theoretical interest, is not crucial for the use of nosological groups as an aid to the validation of questionnaires, or other testing devices, as long as the first deduction can be verified.

In their paper, Sigal et al. do not make explicit the important distinction between these two deductions, and in their discussion constantly switch from one to the other. When we look at their data, it is clear that these are confirmatory of the first deduction; as their Table 1 shows, dysthymics have the lowest extraversion scores (10.50), hysterics have higher scores (12.07), and psychopaths have the highest (14.88). In so far as this crucial deduction goes, therefore, the data do not seem to justify their conclusion that "the results suggest that either the hysterics and dysthymics cannot be used in the proposed manner, or that the E and N scales do not measure introversion-extraversion and neuroticism, or that both statements are true." As far as the first deduction goes the results suggest, on the contrary, that the extraversion scale puts the groups in the respective positions allocated to them by Jung's hypothesis, to wit, the hysterics and psychopaths towards the extraverted end of the scale, the dysthymics towards the introverted end. Needless to say, all neurotic groups have higher neuroticism scores than the normals—16.33 as against 11.62 for the combined groups.

The second error in their argument is related to what would presumably be their answer to the previous point. They would object, I imagine, that not all the differences I mention are in fact significant; indeed, only the dysthymic-psychopathic difference is statistically significant between the nosological groups. The answer to this point is

[1] Formally, the argument may be put in the form of an equation: extraversion:introversion = hysteria/psychopathy:dysthymia. It will be seen that the position of the normal group does not affect this formula, as this group does not enter into it.

relatively simple. A proper test of an hypothesis can only be made when *the number of cases used is sufficient to bring out the significance of the findings.* The number of cases used in this study is very small indeed; the total number is 52, and the number of psychopaths, to take but one instance, is only 8. When it is realized that the reliability of nosological classification is relatively low, and that consequently the criterion itself, even if valid, would not be highly reliable, then the need for much larger numbers becomes apparent. Sigal et al. might argue that their method of diagnosis was superior to that used by experienced psychiatrists of good standing, but such an assertion would require proof which is not contained in their paper.[2] If their findings had been directly contrary to the hypothesis, i.e., if the dysthymics had emerged as the most extraverted group, this lack of numbers might not have mattered so much. As it is, however, *their findings agree with prediction but fail to do so significantly.* One would have imagined that, before coming to such a strongly adverse conclusion, investigators concerned with the facts of the situation would have tried to obtain a larger number of cases to put the issue beyond a doubt.

This argument would be strengthened if it could be shown that other investigators were able to obtain similar results to theirs, and that the added cases rendered the observed differences significant. Fortunately, such further (unpublished) studies have been carried out in this department by A. Jensen, G. Claridge, and others, so that we now have available results on altogether some 200 neurotics, including the group tested by Sigal et al.[3] The total results, whether including their cases or not, are rather similar to theirs in placing the dysthymics at the introverted end, the psychopaths at the extreme extraverted end, and the hysterics in between; all differences between groups are statistically significant. The only apparent difference between these more inclusive results and those given by Sigal et al. lies in the fact that hysterics tested by them are lower in neuroticism than those tested later; this discrepancy is presumably related to their criteria of selection, which are a little unusual, and likely to lead to the exclusion of hysterics high on neuroticism. It may be noted parenthetically that when writing their paper, Sigal et al. were fully aware of some of these data, namely, those collected by A. Jensen, so that they must have been aware of the likelihood that if they had amassed data on larger numbers, their stress on the lack of significance in their data could not have been maintained.

We now come to the third point which will be dealt with briefly because it is still the subject of investigation. This relates to the fact that normal groups score at about the same level as do hysterics as far as the extraversion scale is concerned. Here, again, it may first of all be noted that the group of normals used by Sigal et al. is made up of students, and consequently not particularly well matched with the neurotic groups with respect to education, age, and class. It would have been better to have used the original standardization group, which was not only larger, but also much better matched for these variables (1). The student group used by Sigal et al., is slightly more extraverted and considerably more neurotic than the original standardization group; this fact may be in part responsible for some of the failures of Sigal et al. to obtain significant differences as, for instance, between the normal and the hysteric groups. They make no mention of this difference between their comparison group and the original standardization group.

However, when all is said and done, the more recent data on neurotic groups, as well as on much larger random samples of normals, leave no doubt that essentially Sigal et al. are correct in stating that *hysterics are not significantly more extraverted than normals* but that psychopaths are; dysthymics, of course, are significantly more introverted. There are two possibilities here. The first is that Jung was mistaken in his hypothesis about the position of normals, and the questionnaire data may be accepted as they stand. This view would in no way reduce the value of nosological groups for the purpose of validation studies, but would require a change in the statement of the theory regarding the degree of extraversion of hysterics as compared with normals. The second possibility is that there are certain distorting factors which make the hypothesis of *linear regressions* unlikely. There is some evidence to support the second possibility. In normal groups the correlation between extraversion and neuroticism is quite insignificant and in the neighborhood of $-.1$. In neurotic groups we

[2] The unwary reader might assume that the diagnostic criterion used by Sigal et al. ensured high reliability because of the unanimity of three judges. This, unfortunately, is not so. It must be borne in mind that judges were not concerned with the patients and their symptoms in coming to a decision, but merely with the written records concerning each patient. However reliable the interpretation of the record may have been, this does not tell us anything about the reliability of the psychiatrist in arriving at his decision as to what to put into the record. The actual reliability of the diagnostic criterion would appear to depend much more on the latter than on the former.

[3] These data are summarized in the manual of the MPI, published by University of London Press, London, 1958. Also included there are data on criminals, reference to which is made below, and on psychosomatic patients; the large standardization group is constituted by a random sample of the population obtained by quota sampling methods.

have universally found the correlation to be significant and negative; the r values are usually in the neighborhood of $-.3$ to $-.4$. This result might be thought to be due to a selection factor that prevents subjects with high extraversion and high neuroticism scores from being sent to mental hospitals; they might be sent to prisons, for instance. However, recent large-scale studies of prison populations, carried out with the MPI, do not bear this out; scores of these groups are almost identical with scores of hysterics. Furthermore, it has been found that in normal groups the correlation between E and N in the 20% highest on neuroticism is again in the range of $-.3$ to $-.4$, although over the whole range it is between zero and $-.1$. Thus, clearly, one of the regression lines is nonlinear, and it is this failure of linearity which may in part be responsible for the failure of the hysterics to have more extraverted scores. It would be premature to speculate about the reasons for this nonlinearity; it may be due to such factors as response set (if hysterics have a response set towards answering "yes," then they would achieve high scores on neuroticism, but only average scores on extraversion where some "yes" answers are scored one way, some another), or it may be due to positive feedback in the reaction between strong innate emotionality and conditioning processes theoretically underlying the manifestations of dysthymia (2). Research is in progress at the moment to decide this point. At the present moment, it is certainly too early to come to any definitive conclusions on this point.

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NEGATIVE EVIDENCE CONCERNING THE GENERALITY OF RIGIDITY[1]

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FOR several years there has been lively debate on the question of whether behavioral rigidity, as measured by the familiar *Einstellung* test, operates as a general personality trait (4, 6, 7). The present study was undertaken to test for a general factor of rigidity among junior high school pupils.

Twelve experimental tests were developed on the *Einstellung* principle, in which a mental set was induced by a series of problems solved in the same manner (set problems), followed by a similar-appearing problem that demanded a new solution method (extinction problem). The test materials involved three types of reasoning ability—spatial, numerical, and verbal.

Two forms of each of the following instruments were devised: 1. Measures of spatial relations: Blocks Test, involving the Wechsler-Bellevue blocks; Figures Test, adapted from that reported by Schroder and Rotter (8); and Squares Test, adapted from Tate (9). 2. Measures of numerical reasoning: Number Series Test, and a modification of the Luchins Water Jar Test. 3. Measure of verbal reasoning: Disarranged Words Test. In the spatial tests, *S*s were required to complete a series of drawings or block designs of similar pattern, and then an extinction item demanding a shift of design or perspective. The Number Series Test required the completion of several series using the same solution formula, after which the solution method changed. Luchins' Water Jar Test was simplified to eliminate large numbers and the "critical" items. The Verbal Test presented a series of jumbled words which *S*s could unscramble in just one fashion, followed by an extinction word which demanded a new type of rearrangement. A fuller description of these measures is available in (3).

Rigidity effect on each test was measured by the time which *S* required to solve the extinction items. At least two types of scores can be taken from the raw times: (*a*) Extinction times alone may be considered; or (*b*) *S*s' time lag relative to set-item times may be computed by finding the

[1] This report is taken from a dissertation submitted to the Graduate School of Arts and Sciences, University of Pennsylvania, in partial fulfillment of the requirements for the degree of doctor of philosophy in education (3). The author wishes to state his indebtedness to M. W. Tate for providing constructive guidance throughout the study.

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