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ON BENDER-GESTALT TEST PERFORMANCE

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A. INTRODUCTION

As a part of a comprehensive study (1) of the effects of lysergic acid diethylamide (LSD-25), the Bender-Gestalt Test (2) was repeatedly administered to a group of subjects under varying experimental conditions and dosages. Since the publication of Pascal's standardization of Bender-Gestalt scoring (5), this test has become available as an instrument for measuring the psychological effects of drugs conducing to transitory states which have been likened to schizophrenic psychoses. The cogency of the test derives from the fact that the scores are correlated with the seriousness of psychiatric disorder for subjects of at least normal *IQ* between the ages of 15 and 50 who have had at least a year of high school education. Within these ranges, the scores are not related to sex, drawing ability, *IQ*, or age.

B. METHOD

1. Procedure

Bender's printed test cards (3) and standard administration were used. Any questions which arose during testing were answered in a noncommittal way, essentially permissively, so that the reproductions of the designs might reflect the subjects' idiosyncratic habitual modes of responding to assigned tasks. Erasures, and second attempts without erasure, were allowed. No time limits were observed.

The Bender-Gestalt Test was given as the first test of an initial screening psychological battery, which included the Wechsler-Bellevue, Rorschach, *TAT*, and figure drawings. The tests were administered individually in

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relative privacy and with no drug or placebo suggested. This testing is referred to as the Pre-Test. The Bender-Gestalt Test was repeated on three separate occasions during subsequent group experimental sessions on days when various physiological and motor-perceptual tests and questionnaires were administered. The test was individually administered, although several subjects were given the test in the same room at the same time. The first occasion was after a placebo dose, a cup of water containing no LSD-25. The second was after an oral dose of 50 micrograms of LSD-25 in water. The third occasion was after an oral dose of 100 micrograms of LSD-25 in water. These testings are hereafter referred to as Experiments I, II, and III, respectively. Finally, the Bender-Gestalt Test was repeated as part of a routine, individually administered, terminal battery similar to that used in the Pre-Test except that the subject had an oral dose of 100 micrograms of LSD-25 in water. This testing is referred to as the Post-Test.

Not all subjects had the complete sequence of tests or had them in the regular order. Most subjects were given the Post-Test about two months after the Pre-Test, but in an extreme case about 10 months elapsed between them. Experiment I was followed by Experiment II within about a week for most subjects, but in one case they were six weeks apart. Similarly, Experiment II was followed by Experiment III ordinarily at an interval of about a week. In order that as much data as possible might be utilized, comparisons of maximum size samples of relevant pairings of tests have been made, in preference to an approach which would involve analysis of the sequence of performances of the rather small number of subjects who took the test all five times in the precise order outlined above.

2. *Subjects*

The subjects, mostly recruited from university campuses, were paid volunteers who spent the greater part of a day at the experimental laboratory, either alone or in groups of from three to six, for each of the various phases of experimentation. There were 13 women aged 22 to 39 years, mean age 28, and 13 men aged 22 to 33 years, mean age 26. Eighteen had had graduate work in some professional or academic field. Three of the men were undergraduates, and two others had pursued their education through the baccalaureate degree. One of the women was in college, one had had nursing training, and one had had business school training beyond high school.

The authors of the Bender-Gestalt scoring manual (5) report a scoring reliability of .90 between their individual scorings of a large set of records.

The scorer of the LSD-25 data obtained a product-moment correlation coefficient of .89 in comparing his scoring of a set of sample records with these authors' scores.

C. RESULTS

The basic hypothesis under investigation is that presumably normal subjects under the influence of LSD-25 will copy the designs of the Bender-Gestalt Test in a manner resembling that of psychiatric patients, and that their deviation scores will increase with increasing dosage of the drug. Six main comparisons of raw deviation scores were studied.

1. *Pre-Test and Experiment I Scores*

In both the Pre-Test and Experiment I the dosage was zero, but in the latter a plain water placebo was administered, and the subjects had reason to believe they had been given a drug of some sort in the group experimental situation. For 17 subjects the mean score for the Pre-Test was 26.12 and for Experiment I was 24.47. The mean difference between pairs of scores of individual subjects was only 1.65 points, which gives a t value of .52 and is clearly not significant.³ Thus, there does not appear to be a significant practice effect tending to improve each subsequent performance. Moreover, there does not seem to be an influence of suggestibility with the placebo artificially conducing to worse performance. It is conceivable, of course, that these two possibilities might operate to offset one another, though Pascal's data on test-retest reliability give no evidence of practice effect. The Pre-Test, however, was given under individual testing conditions, whereas Experiment I was done in a group environment where complex facilitative or disruptive influences might have been exerted. Although the subjects were tested individually, several were tested at the same time, immediately after a period of other tests with other subjects present. Either these environmental effects were negligible or else they were masked by the interplay of practice effects and suggestibility effects with them.

2. *Experiment I and Experiment II Scores*

For 12 subjects the mean of the raw scores under the zero or placebo dose was 20.08 and for the 50 microgram dose was 28.67, indicating less faithful reproduction of the designs under the drug. The mean difference

³The statistical test for the difference between correlated means is described by McNemar (4, pp. 225-226).

between pairs of scores was 8.59 points, which gives a t value of 2.48 and is significant at the .04 level of confidence.

3. *Experiment II and Experiment III Scores*

For 14 subjects the mean of the raw scores under the 50-microgram dose was 32.14 and for the 100-microgram dose was 39.36. The mean difference between pairs of scores was 7.22 points, which gives a t value of 2.24 and is significant at the .05 level. Evidence has thus been adduced that the 100-microgram dose of LSD-25 has a greater effect than the 50-microgram dose on the functioning being measured.

4. *Experiment I and Experiment III Scores*

For 14 subjects the mean of the raw scores under the zero or placebo dose was 23.50 and for the 100-microgram dose was 38.50. The mean difference between pairs of scores was 15 points, which gives a t value of 3.32 and is significant at better than the .01 level. The mean raw score of an educationally similar group of 203 hospital employees and students in Pascal's normative sample (5) was 12.7. The mean raw score of his educationally similar group of 97 psychiatric inpatients and outpatients was 36.6. Since the scoring system was devised expressly to point up the sorts of deviations made by psychiatric patients, it appears from this evidence that a 100-microgram dose of LSD-25 influences test behavior in such a way as to cause it to resemble the functioning of psychiatric patients more closely.

5. *Pre-Test and Post-Test Scores*

For 16 subjects the mean of the raw scores for the Pre-Test, with no drug or placebo, was 23.75 and for the Post-Test under the 100-microgram dose was 31.81. The mean difference between the pairs of scores of the individual subjects was 8.06 points which gives a t value of 2.70 and is significant at the .02 level of confidence. In these two test situations the environment was the same, with personalized psychological testing being done in both, while the dosage changed from zero to 100 micrograms of LSD-25. Hence, this comparison is analogous to the one immediately above, between Experiments I and III, in both of which the group environment prevailed. The findings are similar and serve to support the hypothesis concerning the effect of LSD-25. The mean difference and the variability of scores between the Pre- and Post-Tests are much smaller, however, than is the case between Experiments I and III. Possibly the group experimental conditions in Experiments

I and III increased the disintegrating effect of LSD-25. The personal testing situation of the Pre- and Post-Tests may have tended to counteract the effect of the drug by promoting a sense of security with less impairment of judgment and precision. Also, the Post-Test was the second experience with the maximum dosage for most of the subjects, and some adjustment to it might have been achieved.

6. *Experiment III and Post-Test Scores*

For 11 subjects the mean of the raw scores under the 100-microgram dose in the group situation was 39.63 and under the 100-microgram dose in the individual testing situation was 30.00. The mean difference between pairs of scores was 9.63 points, which gives a t value of 2.29 and is significant at the .05 level. Thus, it is seen that the reactions to the 100-microgram dose of LSD-25 are affected by the prevailing conditions during testing and that significantly less distortion occurs in copying of the designs in the individual testing situation than in the group setting. It has been suggested that a lesser feeling of vulnerability or a greater sense of protectedness is generated in the private testing, and this environmental or interpersonal difference accounts for the bettering of performance. As was mentioned before, the fact that most of the subjects had been under the influence of 100 micrograms of LSD-25 once before may explain the lessened disturbance during the Post-Test. Furthermore, it must be noted that the Bender-Gestalt Test was taken as part of a psychological battery approximately one hour after the administration of LSD-25 for the Post-Test, whereas the designs were copied in Experiment III approximately two to three hours after administration of LSD-25. The importance of such a temporal variation is examined in another study (1).

7. *Sex and Initial Level Differences*

Several subsidiary investigations were carried out by means of comparisons of scores on the Pre-Test as against the post-Test and on Experiment I as against Experiment III; that is, between the zero and 100-microgram doses in the two distinctive testing situations. One of these investigations was on the differential effect of LSD-25 on men as contrasted with women, and the other was on the differential effect of the drug on those who perform well as contrasted with those who do poorly on the initial testing. No statistically significant results were obtained from the very small samples available for study.

8. *Classification of Scores Above and Below Cutoff Point*

Several other approaches to the analysis of Bender-Gestalt performances under LSD-25 are available. One is the categorization of the scores in accordance with a criterion which separates psychiatric patient scores from nonpatient scores. On the basis of the distribution of scores for his normative and validation populations, Pascal found that if a standard score of 67 (equivalent to a raw score of 29 for the educational level of the group of subjects tested under LSD-25) was used as a cutoff point, there were only 5 chances in 100 of including a nonpatient record in a screening. This criterion was adopted for this study. The subjects who took the Bender-Gestalt Test under each of several sets of conditions were divided into two categories. One category consisted of those who obtained raw scores below the cutoff point of 29. These subjects will be regarded as resembling Pascal's nonpatients. The other category, consisting of those whose scores were as high as or higher than the cutoff score, will be considered to be similar to Pascal's psychiatric patients.

Of the 16 subjects who took the Bender-Gestalt Test as part of both the Pre- and Post-Test batteries, 12 obtained scores in the normal category and 4 obtained scores in the psychiatric patient category in the Pre-Test where no drug or placebo was administered. Under a 100-microgram dose in the Post-Test, 7 of the 12 maintained a normal level of performance, while 5 of the 12 shifted to the psychiatric patient level. There were no shifts in the other direction. A chi-square test, with the non-independence of the two groups taken into account and with the correction for continuity applied, gives a value of 3.20, significant at the .08 level of confidence.

Of the 12 subjects who were tested under both Experiment I and Experiment II conditions, 9 obtained scores in the normal category and 3 in the psychiatric patient category in Experiment I. Under a 50-microgram dose in Experiment II, 5 maintained a normal level of performance, while 4 of the 9 shifted to the psychiatric level. One subject shifted from the psychiatric to the normal category. Of the 14 subjects who were tested under both Experiment I and Experiment III conditions, 8 obtained scores in the normal category and 6 in the psychiatric category in Experiment I. Under a 100-microgram dose in Experiment III, 2 maintained a normal level of performance, while 6 of the 8 shifted to the psychiatric level. One subject shifted from the psychiatric to the normal category. Chi-squares for these two comparisons are clearly not significant.

9. *Eight-Point Deviation Score Differences*

Another approach to the study of the effect of LSD-25 on performance of the Bender-Gestalt Test is provided by the differential scoring feature of Pascal's method. Those deviations in response to the designs which characterize hospitalized psychiatric patients and which are infrequently found in the records of nonpatients are scored eight points. These eight-point deviations, of which there are 38 scorable, are mostly extreme rotations, gross fragmentations, or completely unrecognizable alterations of the designs. Tabulation of eight-point deviation scores indicates that as the dosage of LSD-25 was increased there was a concomitant increase in the total number of individual instances of such deviations. Sixteen subjects who obtained a group total of 7 eight-point deviation scores in the Pre-Test obtained 8 such scores in the Post-Test. Twelve subjects who obtained a group total of two such scores in Experiment I obtained five in Experiment II. Fourteen subjects who obtained a group total of seven such scores in Experiment I obtained a total of 14 such scores in Experiment III.

There was also an increase in the number of individual subjects whose records contained such deviations. Of 16 Pre-Test subjects six obtained at least one eight-point score for deviating from the stimulus designs; in the Post-Test seven of these subjects obtained such scores. The number of subjects shifting from no eight-point deviation to one or more such deviations was three, while the number of subjects shifting in the opposite direction was two. Of 12 Experiment I subjects two obtained at least one eight-point score; in Experiment II, four of these subjects obtained such scores. The number of subjects shifting from no eight-point deviation to one or more was three, while the number shifting the other way was one. Of a group of 14 Experiment I subjects six obtained at least one eight-point score; in Experiment III, nine of the same group of subjects obtained such scores. The number of subjects shifting from no eight-point deviation to one or more such scores was five, while the number shifting in the opposite direction was two. Chi-squares for these correlated groups, with corrections for continuity applied, were uniformly nonsignificant.

10. *Tremor Score Differences*

Tremor, as an effect of LSD-25, is readily amenable to study by means of the Bender-Gestalt Test since tremor deviations are scored on four of the nine designs. Tabulation of tremor scores indicates that as the dosage

was increased there was an increase in the number of such scores. Sixteen subjects who produced a total of 10 instances of tremor in the Pre-Test produced 23 instances in the Post-Test. Twelve subjects who produced six instances of tremor in Experiment I produced 14 instances in Experiment II. Fourteen subjects who produced seven instances of tremor in Experiment I produced 20 instances in Experiment III.

The number of individual subjects obtaining a tremor score on one or more of the four designs has been tabulated, also. Of 16 Pre-Test subjects six received at least one tremor score; in the Post-Test, 11 of them received at least one such score. The number of subjects shifting from no tremor to at least one tremor score was nine, while the number shifting in the opposite direction was four. Of 12 Experiment I subjects three received at least one tremor score; in Experiment II, six of them received at least one such score. The number of subjects shifting from no tremor to at least one tremor score was four, while only one shifted the other way. Of 14 Experiment I subjects four received at least one tremor score; in Experiment III, nine of the same group of subjects obtained at least one such score. The number of subjects shifting from no tremor to at least one tremor score was five, while no subject shifted in the other direction. None of the chi-squares for these correlated group comparisons was significant at the .05 level of confidence, though the third of these comparisons, that between Experiments I and III, approached this level. Here again, the number of shifts that entered into the chi-square computations was very small, and the tremor findings must be set down as suggestive rather than conclusive.

D. SUMMARY AND CONCLUSIONS

The effect of LSD-25 was studied by means of the Bender-Gestalt Test performances of 26 paid volunteer subjects. A standardized quantitative scoring system designed to differentiate psychiatrically ill persons from "normal" persons was used to score performances under five experimental conditions involving differences in dosage and in the testing environment. Various comparisons reveal that the mean scores of groups of experimental subjects given 50- and 100-micogram doses of LSD-25 changed a significant amount in such a direction as to resemble more closely the scores of psychiatric inpatients and outpatients. The number of individual experimental subjects who shifted to predominantly or specifically psychotic modes of responding to the test stimuli was not sufficient, however, to demonstrate statistically, in so far as Bender-Gestalt scores furnish a measure of such change,

that LSD-25 in such doses precipitates experimental psychotic-like states comparable to clinical psychotic reactions.

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