

SHORT-TERM EFFECTS OF LSD ON ANXIETY,
ATTITUDES, AND PERFORMANCE

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PREFACE

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SHORT-TERM EFFECTS OF LSD ON ANXIETY, ATTITUDES, AND PERFORMANCE*

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This paper describes the effect of administering d-lysergic acid diethylamide (LSD) to normal subjects, as measured by pre- and one-week post LSD test of anxiety, attitudes, and performance. Several hundred studies have been published on the effects of LSD on human subjects, the majority examining the drug effects during its administration. Several have been concerned with its use as an adjunct to psychotherapy, and a few have suggested that LSD, mescaline, and psilocybin may, at times, produce rapid and long-lasting personality changes even when no psychotherapy is intended. Unger has recently written a review on this subject.⁽¹⁾ Two studies have reported on follow-up questionnaires at post-LSD periods up to three years.^{(2) (3)} A surprisingly high percentage of the subjects claimed beneficial changes in various aspects of their personalities and behavior attributable to LSD. The weaknesses of the questionnaire method should be considered in evaluating these results; however, they appear sufficiently suggestive to warrant more controlled studies of the post-drug phase.

The present study is a preliminary attempt to conduct such an experiment through the use of psychological tests. The post-LSD tests were administered one week following the experience to determine whether sustained effects could be objectified. A more extensive study is planned using a six-month follow-up period; this will be discussed later.

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The tests used in the current study were organized about the general hypothesis that LSD produces a rapid lowering of defense mechanisms similar to that occurring in certain prolonged and intensive group interaction methods. More specifically, it was hypothesized that decreased defensiveness would result in (1) lower anxiety, (2) changes in attitudes, particularly in the form of decreased dogmatism and projection of aggression, and (3) decreased rigidity in certain performance tasks as measured by tests of fluency, flexibility, and originality.

PROCEDURE

The initial test battery required about two and one-half hours to complete and was administered on the day preceding the LSD experience. Alternate forms of the same tests were given one week following the drug exposure. The order of the forms was counterbalanced. A comparison group took the same tests with a one-week interval. The comparison group was used to measure the practice effect in the test-retest situation, and should not be considered as a control for determining the specific drug effects, independent of suggestion, expectation, or other variables.

The experimental subjects received 200 mcg of LSD orally; seven had individual sessions and eight were in pairs. The setting was a quiet and protected hospital day room with couches, music, and visual stimuli provided as desired. The sessions lasted about eight hours. A psychologist who had had extensive personal experience with LSD was present continuously. Special efforts were made prior to the session to allay anxiety concerning the safety of the experience. The subject was assured that he would be well cared for and protected, and should feel free to let himself go with the effects of the drug. Every attempt was made to conduct the session so that the subject would have a pleasant experience. The psychologist was supportive when assistance seemed necessary, but otherwise did not actively participate.

A total of 15 experimental subjects were used; however, the entire test battery was not given to all. One of the main purposes of the current study was to obtain preliminary findings as a guide for a larger experiment with a long-term follow-up. For this reason, tests were added as the

study continued, so the sample size varied as indicated in the tables of results given below. Ten males and five females with a mean age of 36 and a range of 26 to 49 participated. All but four were professional employees of The RAND Corporation. The subjects had no previous experience with LSD or similar agents.

The comparison group consisted of 14 subjects: 9 males and 5 females with a mean age of 34 and a range of 20 to 48. All were employees of The RAND Corporation (11 professional and 3 non-professional).

TESTS

1. Anxiety Measures. Three tests from Cattell's "Objective-Analytic Anxiety Battery" were used as measures of anxiety.⁽⁴⁾ They are well suited for assessing rapid change, since the subject is asked to indicate how he would respond to a current situation as opposed to the more usual anxiety tests which consist of historical questions on the frequency of somatic and emotional events. One test, entitled "Susceptibility to Annoyance," measures the extent to which the subject would find various situations annoying. (Examples: crying children; waiting in line.) A second deals with susceptibility to embarrassment. The subject indicates the extent he would be embarrassed by such situations as forgetting the name of a former friend when meeting him again, or telling a joke at which nobody laughs. A third test is intended to tap the hostility aspect of anxiety, and measures the severity of judgment or punishment the subject would inflict for various actions. (Example: How much should the parents of children who turn in a series of costly false alarms be fined?)

A fourth test is the Marlowe-Crowne Social Desirability Scale (M-C), which is made up of items "defined by behaviors which are culturally sanctioned and approved, but which are improbable of occurrence."⁽⁵⁾ (Example: I have never intensely disliked anyone.) This test correlates positively with the MMPI measures of defensiveness and negatively with Cattell's scores of anxiety.⁽⁶⁾ In the present study it was hypothesized that the M-C scores would decrease in the post-LSD test, indicating a greater willingness to admit common "faults,"

i.e., less defensiveness. Should this be confirmed, along with a post-LSD decrease on Cattell's anxiety scores, it would add additional validity to the findings since these measures normally are negatively correlated.

2. Attitude Measures. The previously mentioned questionnaire studies indicated that LSD subjects frequently reported changes in attitudes, values, and interests. In particular, increased tolerance toward others and their viewpoints is a frequent claim. To measure this variable, alternate test forms were made up of items from the California F scale on authoritarianism and Rokeach's dogmatism scale.^{(7) (8)} (Sample items are: An insult to our honor should always be punished; a group which tolerates too much difference of opinion among its own members cannot exist for long. The subject indicates the extent to which he agrees or disagrees with the statement.)

The Rosenzweig Picture Frustration test was used as a measure of the expression of aggression.⁽⁹⁾ The P-F test consists of a group of cartoons depicting frustrating situations involving two persons. The statement made by one person is given and the subject is asked to fill in the response of the second person. The scoring was in terms of the number of constructive responses given. It was hypothesized that the frequency of these statements would increase in the post-LSD administration.

Another change often reported by LSD subjects is an increased interest in the philosophical meaning of life with decreased emphasis on materialism. To measure this, a test was constructed of Zen-type paradoxes and practical aphorisms.* Examples of the former are: To give up everything is to gain all; he who loves good is indulgent towards evil. Examples of the latter: A bird in the hand is worth two in the bush; a fool and his money are soon parted. It was hypothesized that subjects would find the Zen-type items more meaningful and the practical sayings less meaningful following the LSD experience.

* This test was adapted from one developed by W. W. Harman at Stanford University.

3. Performance Measures. In terms of Guilford's factorial structure, the mental abilities we wished to measure are those described as divergent thinking. Guilford classifies thinking into cognition, production, and evaluation, with production further divided into convergent and divergent thinking.⁽¹⁰⁾ In tests of convergent thinking there is typically only a single answer to each problem. Divergent thinking is less goal-bound, and is generally characterized by the fluency and flexibility of responses. Measurement is in terms of the number of appropriate responses produced in a limited time period.

The principle divergent thinking factors measured are associational fluency, ideational fluency, spontaneous flexibility, and originality. The description of these factors follow from the test examples.

Associational fluency: List words similar in meaning to the word "hard."

Ideational fluency: Name fluids that will burn.

Alternate uses: List alternate uses for a common object such as a newspaper. This test has principal loadings on spontaneous flexibility and secondary loadings on originality.

Alternate signs: Express the meaning of a word by showing as many related symbols or signs as possible. This test is intended to measure originality -- in particular the requirement for redefinition and transformations.⁽¹¹⁾

Consequences: What would be the results if people no longer needed or wanted sleep? This test is usually scored for both quantity and quality (originality) of responses. In this study, however, only quantity of responses was scored and, as such, it measures ideational fluency.

Remote associations: What word is related to "surprise," "line," and "birthday?" (The answer: "party.") This test was developed by Mednick, and is factorially complex in Guilford's terminology. It was included because the author reports some relatively high correlations between scores on this test and ratings of creativity.⁽¹²⁾

RESULTS

The results of two administrations of the above tests to the comparison and experimental groups are given in Tables 1 and 2. With the exception of the "Severity of Judgment" test, all tests consisted of alternate forms, and were administered in counterbalanced order. All tests requiring subjective scoring were scored without knowledge of the order of administration. Since the present samples consist of primarily professional research personnel, and are not typical of the usual population from which tests norms are derived, additional norms for college students are given for comparison when available.

Table 1 presents the results of the anxiety and attitude tests. The mean scores for the comparison group demonstrate only small and inconsistent changes from the first to the second administration, all of which are well within the expected chance fluctuations. We conclude that there is no evidence of practice effect for these tests. Accordingly, the t-ratios for the individual tests shown in Table 1 refer to the differences between the pre- and post-LSD administrations for the experimental group. All three of Cattell's anxiety measures show decreases following LSD; the annoyance and embarrassment differences are significant beyond the two- and five-per-cent levels of confidence, respectively. The Marlowe-Crowne Social Desirability Scale (defensiveness) shows a rise, whereas a drop was hypothesized, but the difference is not significant.

All of the attitude measures show changes in the predicted direction in the experimental group. The drop in the dogmatism score and the increase in constructive responses to the Rosenzweig test are just short of significance at the five-per-cent level for a two-tailed t-test. Since the direction of change is predicted in advance, a one-tailed t-test may be applied in this instance, and the changes on both tests are significant beyond the five-per-cent level for this criterion. The meaningfulness of the Zen-type paradoxes increases and that of the practical sayings decreases as hypothesized, but the differences are not significant.

Table 2 lists the results for the performance tests. There is a distinct practice effect evident in the comparison-group results

Table 1

ANXIETY AND ATTITUDE MEASUREMENTS

| Test | Mean College Students | Comparison (N = 14) | | | | Experimental | | | | t |
|-------------------------|-----------------------|---------------------|---------------|-----------------|----|---------------|---------------|-----------------|----|------|
| | | Mean 1st Test | Mean 2nd Test | Diff. (2nd-1st) | N | Mean 1st Test | Mean 2nd Test | Diff. (2nd-1st) | N | |
| Anxiety | | | | | | | | | | |
| Annoyance | 31.5 | 25.6 | 26.8 | 1.2 | 10 | 27.4 | 19.8 | -7.6 | 10 | 2.94 |
| Embarrassment | 24.5 | 20.2 | 20.8 | 0.6 | 10 | 20.5 | 15.8 | -4.7 | 10 | 2.27 |
| Severity of Judgment | 49.7 | 40.6 | 41.0 | 0.4 | 10 | 39.5 | 36.4 | -3.1 | 10 | 1.60 |
| M-C Scale Defensiveness | 6.6 | 3.5 | 4.1 | 0.6 | 8 | 4.2 | 5.1 | 0.9 | 8 | 1.26 |
| Attitude | | | | | | | | | | |
| Dogmatism | -- | 71.7 | 64.8 | -6.9 | 10 | 66.8 | 55.6 | -11.2 | 10 | 2.09 |
| Rosenzweig P-F test | -- | 2.6 | 3.0 | 0.4 | 8 | 1.9 | 3.3 | 1.4 | 8 | 2.08 |
| constructive response | | | | | | | | | | |
| Paradoxes | -- | 25.6 | 23.2 | -2.4 | 10 | 28.0 | 31.6 | 3.6 | 10 | 1.59 |
| Practical sayings | -- | 23.4 | 22.1 | -1.3 | 10 | 18.9 | 15.2 | -3.7 | 10 | 1.77 |

which is approximately equal to the gains shown by the experimental group in the post-LSD tests. These statistics are most appropriately treated by an analysis of variance; however, since it is obvious that pre- and post-LSD results are not significantly different after the practice effect is considered, a simpler procedure is adopted. The "net difference" for the experimental group is defined as $(E_2 - E_1) - (C_2 - C_1)$, where E_1 , E_2 and C_1 , C_2 represent the means of the first and second testing in the experimental and comparison groups respectively. The t-ratios shown in Table 2 were found by dividing this value by the standard error of the difference between E_1 and E_2 . We conclude that these results provide no evidence of change in performance resulting from the LSD administration.

In addition to the fluency and flexibility tests described above, Rapaport's word-association list of 60 words⁽¹³⁾ was given, in an attempt to measure possible changes in the associational responses resulting from the LSD administration. This approach stemmed from a study by Weintraub, Silverstein, and Klee.⁽¹⁴⁾ They gave the word-association test to comparison and experimental groups with a one-week interval between the association and reproduction portions.* The experimental group received LSD $1\frac{1}{2}$ hours before the reproduction portion. Under these conditions, it was found that the comparison group "corrected" 62 per cent of their initially deviant or statistically remote associations when given the reproduction portion of the test. Thus, in spite of the instructions to repeat the same response, there was a tendency to give a more conforming association at the second testing. In contrast, the experimental group corrected only 27 per cent of their initially deviant associations. The authors interpreted the tendency to correct deviant responses in the comparison group as an unconscious mobilization of ego defenses, whereas this function was disturbed under the effect of LSD.

*The word-association test is in two parts. In the association portion, the subject is instructed to respond quickly to the stimulus word with the first word that comes to mind. In the reproduction portion, he is asked to attempt to give the same response that he gave initially.

Table 2
PERFORMANCE MEASURES

| Test | Mean College Students | Comparison (N = 14) | | | Experimental | | | | | t |
|-----------------------|-----------------------|---------------------|---------------|-----------------|--------------|---------------|---------------|-----------------|-----------|------|
| | | Mean 1st Test | Mean 2nd Test | Diff. (2nd-1st) | N | Mean 1st Test | Mean 2nd Test | Diff. (2nd-1st) | Net Diff. | |
| Associational fluency | 6.3 | 12.1 | 13.4 | 1.3 | 14 | 10.9 | 12.1 | 1.2 | -0.1 | 0.12 |
| Ideational fluency | 26.0 | 29.2 | 35.3 | 6.1 | 8 | 32.2 | 36.8 | 4.6 | -1.5 | 0.59 |
| Alternate uses | 11.2 | 15.9 | 16.8 | 0.9 | 14 | 13.2 | 14.6 | 1.4 | 0.5 | 0.71 |
| Alternate signs | -- | 9.4 | 9.2 | -0.2 | 8 | 8.6 | 9.0 | 0.4 | 0.6 | 0.54 |
| Consequences | 27.2 | 33.9 | 37.5 | 3.6 | 14 | 28.9 | 32.9 | 4.0 | 0.4 | 0.32 |
| Remote associations | -- | 10.3 | 12.1 | 1.8 | 15 | 8.6 | 9.9 | 1.3 | -0.5 | 0.38 |

Table 3
WORD ASSOCIATION TEST RESULTS

| Study | N | % Popular Association | Mean No. Deviant Assoc. | % Exact Reprod. | % Deviant Assoc. Corr. |
|---------------------------------------|----------|-----------------------|-------------------------|---------------------------|---------------------------|
| Weintraub Comparison Experimental | 19 6 | 56.8 -- | 7.3 6.2 | 62.9 62.8 ^a | 62.1 27.0 ^a |
| Present Study Comparison Experimental | 14 10 | 55.0 50.2 | 17.8 19.4 | 62.8 63.9 | 39.4 34.6 |

^aTest given 1-1/2 hours after ingesting 2 mcg LSD/kg body weight.

The present study attempted to determine if this tendency not to correct deviant associations is maintained during the period following LSD. The association portion of the test was given on the day preceding the LSD administration, and the reproduction portion one week following. The comparison group took the same tests, also with a one-week interval. The results are compared with those found by Weintraub *et al.* in Table 3. The percentage of popular associations, as objectively defined by Rapaport, is similar for the two studies; however, the mean number of deviant associations is much larger for the subjects in the present study. It seems unlikely that this is due to the method of scoring, since one of the co-authors of the Weintraub study scored the tests for all four groups.* The percentage of exact reproductions is almost identical for all groups, but the percentage of deviant associations corrected by the comparison group for the present study is much smaller than that found by Weintraub. In the present study the experimental group corrected a smaller percentage of the deviant responses than did the comparison group, but the difference is not significant ($t = 1.04$).

Table 4 gives a further breakdown of the deviant associations for the current study. They are first divided according to Rapaport's distinction between serious deviant associations, such as distant or clang responses; and minor deviations, such as phrase completions. The Rapaport list is made up of traumatic ("suicide," "masturbate") and neutral ("dog," "table") words; and the deviant responses are also treated by these categories in Table 4. The experimental group corrects a smaller percentage of deviant responses in all categories than does the comparison group, but none of the differences approach significance.

The marked differences in the mean number of deviant associations and the percentage corrected found by Weintraub and the present study (Table 3) may be due to the quite dissimilar subjects. The former

*The authors wish to thank Dr. A. B. Silverstein for his generous cooperation in scoring the word-association tests for the present study.

Table 4

CORRECTION OF DEVIANT ASSOCIATIONS

| Deviant Association | Mean No. Deviant Assoc. | | % Deviant Assoc. Corrected | | |
|----------------------|-------------------------|--------------|----------------------------|--------------|------|
| | Comparison | Experimental | Comparison | Experimental | t |
| Serious | 6.4 | 6.6 | 42.7 | 40.9 | .23 |
| Minor | 11.4 | 12.8 | 37.5 | 31.2 | 1.12 |
| Traumatic (20 words) | 5.7 | 7.1 | 38.4 | 32.4 | .77 |
| Neutral (40 words) | 12.1 | 12.3 | 39.9 | 35.8 | .72 |

Table 5

SUBJECTIVE DESCRIPTIONS OF LSD EXPERIENCE FOR THREE GROUPS

| Item | Percentage | | |
|---|------------------|--------------------|----------------------------|
| | Ditman N = 74 | Janiger N = 194 | Present Study N = 15 |
| Experience described as: | | | |
| Pleasant | 72 | 66 | 60 |
| Upsetting | 18 | -- | 20 |
| Would like to repeat | 66 | 74 | 87 |
| An experience of great beauty | 66 | -- | 67 |
| Greatest thing that ever happened to me | 49 | -- | 60 |
| After-effects of experience were: | | | |
| Enhanced understanding of self and others | 54 | 61 | 67 |
| Reduced anxiety and tension | 34 | -- | 53 |
| Better relations with others | 37 | 41 | 40 |

samples were made up of young military service personnel, while the latter was primarily a professional research group. Probably, the tendency to correct deviant responses is partly a function of the set that the subject adopts regarding the testing situation. Weintraub's service personnel may have viewed it as a "doctor-patient situation" which called for a conforming set. The disinhibiting effect of LSD would tend to dissolve such a set, resulting in a smaller percentage of deviant associations corrected. It would be interesting to investigate whether subjects similar to those used by Weintraub would show a significant retention of this disinhibition at post-LSD periods of a week or more.

In addition to the pre- and post-LSD tests described above, the experimental subjects were given a brief questionnaire pertaining to their subjective impressions one week following the experience. It was similar to those given by Ditman et al.⁽²⁾ and Janiger.* The results for a few items are compared with these studies in Table 5. In all three cases the answers were given on a four-point scale ("not at all," "a little," "quite a bit," "very much") and the results are the percentage of subjects responding in the last two categories. The Ditman questionnaire was given six months to three and one-half years after the LSD experience. The dosage was 100 mcg and three-fourths received a single session. The average interval between LSD and the follow-up questionnaire for the Janiger data was ten months. The average dosage was 171 mcg and 60 per cent received a single session. Of this group, 38 per cent took LSD in conjunction with psychotherapy.

The results for the three studies are similar. Claims of benefit are somewhat higher for the current study with a follow-up period of only one week. Both Ditman and Janiger found that such claims decreased as a function of the interval between the LSD administration and the completion of the questionnaire. The latter found that those persons for which the interval exceeded one year claimed benefits about two-thirds as frequently as did those for whom the interval was three months or less.

*These data are given in more detail in (3).

DISCUSSION

The present study found certain significant short-term changes in measures of anxiety and attitudes as a result of a single administration of LSD. An immediate question arises concerning the extent the observed changes may be due to a placebo effect. When larger than minimal LSD dosages are used, this cannot be resolved by the usual single- or double-blind experimental design since, even with a "positive" placebo which mimics some of the side effects of LSD, both the subject and experimenter typically are able to detect the difference. Actually, attempts to separate specific drug effects from those due to subject expectation and motivation are meaningful only when we hypothesize that the observed changes are due to a sustained chemical effect. If it is hypothesized that the LSD state reduces defense mechanisms, resulting in psychological insights and learning phenomena, we cannot expect to separate the drug effects from the set and setting any more than we could expect to measure the effect of the theoretical constructs of a particular school of psychotherapy independently of the acceptance of the method by the patient and the therapist. There have been no experiments which specifically examined the relation of subject expectation and post-LSD effects; however, there is a striking variance among subject reactions in early experiments when LSD was thought to produce "model psychoses," and those shown in Table 5. Subjects who expected to undergo an LSD-induced psychosis typically reported unpleasant symptoms and did not wish to repeat the experience⁽¹⁵⁾ whereas administration of LSD under the conditions described in the present study produces quite different results.

As mentioned earlier, a larger study of the effects of administering LSD to normals is planned, which is expected to clarify some of the questions related to the present results. Both the experimental and comparison groups will be drawn from a defined population which has previously been canvassed regarding their willingness to participate in such an experiment. This will provide some information concerning the extent the results can be generalized to larger populations. Two comparison groups will be utilized, one consisting of subjects who indicate a willingness to take LSD, the other of subjects who decline

this type of participation. The experimental group will receive three LSD sessions at one-month intervals with follow-up testing at post-LSD periods of two weeks and six months. It is also planned that some physiological measures of anxiety will be added to the tests used in the present study.

SUMMARY

This study describes the short-term effects of administering LSD to normals as measured by pre- and one-week-post-LSD tests of anxiety, attitudes, and performance. The hypothesis tested was that LSD would produce a rapid lowering of defenses resulting in (1) lower anxiety, (2) attitudinal changes, particularly in the form of decreased dogmatism and projection of aggression, and (3) increases in certain performance tests of fluency, flexibility, and originality. The samples consisted of 15 experimental and 14 comparison subjects, most of whom were professional research personnel.

The hypothesis was generally confirmed for the anxiety and attitude tests, but there were no gains in the performance tests beyond that attributable to practice effect as measured in the comparison group. An attempt was made to determine if certain LSD-induced changes in the word-association test results, as found in a previous study, were retained in the post-LSD period. The results were inconclusive, apparently because of the lack of similarity between the samples of subjects.

A larger study is planned using a six-month follow-up period.

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