

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 tests of anxiety, attitudes and performance. Several hundred studies have been published on the effects of LSD on human Ss, 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 reviewed the literature on this subject (15). Two studies have reported on follow-up questionnaires at post-LSD periods as long as three years (4, 8). A surprisingly high percentage of Ss have claimed beneficial changes in various aspects of their personalities and behavior, which they attributed 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.

The tests used in the study reported here 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 developed by the National Training Laboratory (10). When this takes place in a secure and supportive environment, the initial shock and anxiety which accompanies the sudden relinquishing of defenses will frequently be followed by S's realization that he is not overwhelmed and defeated, but rather is free from the burden of protecting against symbolic threats. It is predicted that Ss will continue to exhibit decreased defensiveness in the post-LSD period which will 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 Ss received 200 mcg. LSD orally; seven had individual sessions and eight were in pairs. The setting was a quiet and protected hospital day room with

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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. *S* 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 *S* would have a pleasant experience. The psychologist was supportive when assistance seemed necessary, but otherwise did not actively participate.

A total of 15 experimental *Ss* was used; the entire test battery, however, 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. Ten males and five females with a mean age of 36 (range, 26 to 49) participated. All but four were professional employees of The RAND Corporation. *Ss* had no previous experience with LSD or similar agents.

The comparison group consisted of 14 *Ss*: nine males and five females (mean age, 34; range, 20 to 48). All were employees of The RAND Corporation (11 professional and three non-professional).

TESTS

Anxiety measures: Three tests from Cattell's Objective-Analytic Anxiety Battery were used as measures of anxiety (14). They are well suited for assessing rapid change, since *S* 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 *S* states he would find various situations annoying

(Examples: crying children; waiting in line). A second deals with susceptibility to embarrassment. *S* indicates the extent to which 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 *S* says he 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 was 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" (3) (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 (5). In the present study, it was predicted that the M-C scores would decrease in the post-LSD test, indicating a greater willingness to admit common "faults," i.e., less defensiveness. Confirmation of this prediction, along with a post-LSD decrease on Cattell's anxiety scores, would add validity to the findings since these measures normally are negatively correlated.

Attitude measures: The previously mentioned questionnaire studies indicated that LSD *Ss* frequently report 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 (1, 12). (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. *S* 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 (13). 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 S is asked to fill in the response of the second person. The scoring was in terms of the number of constructive responses given.⁴ It was predicted that the frequency of these statements would increase in the post-LSD administration.

Another change often reported by LSD Ss is an increased interest in the philosophical meaning of life with decreased emphasis on materialism. To measure this, a test was constructed of Zen-like paradoxes and practical aphorisms.⁵ 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 felt that Ss would find the "Zen" items more meaningful and the practical sayings less meaningful following the LSD experience.

Performance measures: In terms of Guilford's factorial structure, the mental abilities we wished to measure may be described as divergent thinking. Guilford classifies thinking into cognition, production and evaluation, with production further divided into convergent and divergent thinking (7). 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.

⁴The constructive score (C) is a combination of the e, i and m factors of Rosenzweig, but with a change in emphasis, such that the C responses are considered to show the respondent's willingness to assume the initiative in working out a constructive solution to the frustrating situation.

⁵This test was adapted from one developed by W. W. Harman at Stanford University.

The principle divergent thinking factors measured are associational fluency, ideational fluency, spontaneous flexibility, and originality. A description of these factors follows 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 [6].)

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 [9].)

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.

Table 1 presents the results of the anxiety and attitude tests. As mentioned earlier, the

TABLE 1
Anxiety and Attitude Measurements

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

comparison group is used solely to measure practice effect in the test-retest situation. The question of differences in the alternate test forms is resolved by counterbalanced administration, and there was no placebo introduced in the comparison group. The mean scores for the comparison group in Table 1 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 in these tests. For this reason, the *t*-ratios for the individual tests in Table 1 refer to the differences between the pre- and post-LSD administrations for the experimental group rather than the difference between the change scores for the comparison and experimental groups. The former test is preferred because it avoids introducing the additional variance of the individual test means for the comparison group when, on the basis of the overall results, there is clearly no evidence for the presence of practice effects.

All three of Cattell's anxiety measures show decreases following LSD; the annoyance and embarrassment differences are significant beyond the .02 and .05 levels, respectively. The Marlowe-Crowne Social Desirability Scale (defensiveness) shows a

rise, a change in direction opposite to that predicted, but the difference is not significant.

All 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 .05 level. The meaningfulness of the Zen paradoxes increases and that of the practical sayings decreases, 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 which is approximately equal to the gains shown by the experimental group in the post-LSD tests. The *t*-ratios shown in Table 2 refer to differences between the change scores for the comparison and experimental groups (net difference). All of the differences are decidedly non-significant. We concluded 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 (11) 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, Sil-

TABLE 2
Performance Measures

Test	Comparison (N = 14)			Experimental				Experimental-Comparison	
	Mean 1st Test	Mean 2nd Test	Diff. (2nd-1st)	N	Mean 1st Test	Mean 2nd Test	Diff. (2nd-1st)	Net Diff.	t
Associational fluency....	12.1	13.4	1.3	14	10.9	12.1	1.2	-0.1	.07
Ideational fluency.....	29.2	35.3	6.1	8	32.2	36.8	4.6	-1.5	.33
Alternate uses.....	15.9	16.8	0.9	14	13.2	14.6	1.4	0.5	.48
Alternate signs.....	9.4	9.2	-0.2	8	8.6	9.0	0.4	0.6	.43
Consequences.....	33.9	37.5	3.6	14	28.9	32.9	4.0	0.4	.15
Remote associations.....	10.3	12.1	1.8	15	8.6	9.9	1.3	-0.5	.35

verstein and Klee (16) in which the word association test was administered to comparison and experimental groups with a one-week interval between the association and reproduction portions.⁶ The experimental group received LSD one and one-half 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, 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 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 of these are com-

pared in Table 3 to those found in the study by Weintraub *et al.* The percentage of popular associations, as objectively defined by Rapaport, is similar for the two studies; the mean number of deviant associations is much larger for the subjects in the present study, however. It seems unlikely that the difference is due to the method of scoring, since one of the co-authors of the Weintraub study scored the tests for all four groups.⁷ 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 corrected a smaller percentage

⁶The word-association test is in two parts. In the association portion, *S* 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.

⁷The authors wish to thank Dr. A. B. Silverstein for his generous cooperation in scoring the word-association tests for the present study.

of deviant responses in all categories than did the comparison group, but none of the differences approaches significance.

The marked differences in the mean number of deviant associations and the percentage corrected found in the two studies (Table 3) may be due to the quite dissimilar Ss. The former 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 *S* 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 Ss similar to those used by Weintraub would show a significant retention of

TABLE 3
Word Association Test Results

Study	N	% Pop- ular Associa- tion	Mean No. Deviant Assoc.	% Exact Reprod.	% Deviant Assoc. Corr.
Weintraub Comparison	19	56.8	7.3	62.9	62.1
Experimental	6	—	6.2	62.8*	27.0*
Present Study Comparison	14	55.0	17.8	62.8	39.4
Experimental	10	50.2	19.4	63.9	34.6

* Test given one and one-half hours after ingesting two mcg. LSD/kg body weight.

TABLE 4
Correction of Deviant Associations

Deviant Assoc.	Mean No. Deviant Assoc.		% Deviant Assoc. Corr.		<i>t</i>
	Com- parison	Experi- mental	Com- parison	Experi- mental	
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	Per Cent		
	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
The 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 ten- sion	34	—	53
Better relations with others	37	41	40

this disinhibition at post-LSD periods of a week or more.

In addition to the pre- and post-LSD tests described above, the experimental Ss were given a brief questionnaire intended to tap their subjective impressions one week following the experience. It was similar to those given by Ditman *et al.* (4) and Janiger.⁸ 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 given as percentages of Ss responding in the last two categories. The Ditman questionnaire was given six months to three and one-half years after the LSD experience in which the dosage had been 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 simi-

⁸ These data are given in more detail in (8).

lar. 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 investigator reported that those persons for whom the interval exceeded one year claimed benefits about two-thirds as frequently as did those for whom the interval was three months or less.

DISCUSSION

The present study found certain significant short-term changes in measures of anxiety and attitudes following a single administration of LSD. An immediate question arises concerning the extent to which the observed changes may be due to a placebo effect.

This is a difficult problem to resolve because the very dramatic psychic effects of LSD make it impossible to carry out a single- or double-blind experimental design, even when a "positive placebo," which mimics some of the side-effects of LSD, is used in the control group. If the LSD group, in such a study, shows significantly larger changes in the post-drug stage than does a control group, it cannot be concluded that the difference is due to the specific effects of LSD, independent of *S* expectation and experimenter suggestion. This follows because the interaction of these variables with the LSD and placebo states is not necessarily equivalent. On the other hand, if there are significant changes between the pre- and post-drug scores for both the experimental and control groups, but not a significant difference between the two groups, it may be concluded that changes following the administration of LSD in the given set and setting are not unique to this drug. While it is certainly preferable to separate effects of expectation and suggestion from specific drug effects, it is not so crucial as if we were testing the hypothe-

sis that the long-lasting effects of administering LSD are due to a sustained chemical reaction. Indeed, if it is thought that post-LSD changes are brought about by reduced defense mechanisms, resulting in psychological insights and learning phenomena, it is difficult to conceive of the specific drug effects independent of the set and setting. There have been no experiments which specifically examine the relation of *S* expectation and post-LSD effects; however, there is a striking difference between *S* reactions in early experiments when LSD was thought to produce "model psychoses," and those shown in Table 5. *Ss* who expected to undergo an LSD-induced psychosis typically reported unpleasant symptoms and did not wish to repeat the experience (2), 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 normal individuals is planned, using amphetamine as a "positive placebo" for the control group. *Ss* will receive three drug sessions at one-month intervals with follow-up testing at post-drug 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 normal *Ss* as measured by pre- and one-week-post-LSD tests of anxiety, attitudes and performance. The hypothesis tested was that LSD would produce decreased defensiveness in the post-LSD period 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 *Ss*, most of whom were professional research personnel.

The hypothesis was confirmed for some of the anxiety and attitude tests, but there were no gains in the performance tests beyond those attributable to practice effects 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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