LONG LASTING EFFECTS OF LSD ON NORMALS[1]

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This is a report of a study designed to measure personality, attitude, value, interest, and performance changes resulting from the administration of LSD to normals. Several investigators using LSD with humans in nontherapy experiments have observed that some of their subjects report various lasting effects attributable to the drug experience.[1,2] In addition, the recent controversy over the nonmedical use of LSD has given rise to numerous claims and counterclaims in this regard. We have previously reported on a pilot study in which tests of anxiety, attitudes, and creativity were given to 15 subjects prior to, and one week following, a single 200 microgram LSD session. Some significant changes in the anxiety and attitude tests were observed, but none were found for the creativity measures.[3]

The assessment of lasting effects of hallucinogens involves extradrug variables to a greater extent than do most drug studies. We are asking, in effect, whether a dramatic drug-induced experience—one which temporarily dissolves the primacy of habitual perceptions of self image, environment, beliefs, and values—will have a lasting impact on the individual's personality. We would expect any such impact to be influenced by the person's prior personality, motivation, and expectation, and by the presence of suggestion and reinforcement prior, during, and after the drug experience. In the present study, the subjects volunteered for a paid experiment without prior knowledge of its nature. A large battery of psychological tests was administered prior to a series of three, 200 microgram LSD sessions, and again at intervals following the third session. The hypothesized post-drug personality changes include those most commonly reported in questionnaire evaluations: (1) lower anxiety, (2) attitude and value changes, primarily characterized by greater introspection, less defensiveness, aggression and rigidity, less materialism and competitiveness, and greater tolerance towards others; (3) increased creativity and (4) enhanced interest and appreciation of music and art.

SELECTION OF SUBJECTS

The subjects were US-born male graduate students who responded to an advertisement for experimental subjects to be paid at the rate of $2 per hour. The Minnesota Multiphasic Inventory (MMPI) was administered for screening, and the Myers-Briggs Type Indicator[4] and Aas' Hypnotic Susceptibility[5] for matching experimental and control groups. A subsequent interview dealt, in part, with the subject's experience, knowledge, and attitude on LSD and other hallucinogens. During this interview, the subjects were told that the experiment involved the use of drugs and they might or might not receive LSD.

Of the 155 subjects tested and interviewed in December 1964, 12% knew a considerable amount about LSD, 15% had never heard of it, and the remainder had

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Table 1.—*Personality Differences Between Students With Positive, Neutral, and Negative Attitudes Toward Taking LSD*

Variable	Positive N=20	Neutral N=71	Negative N=36	F Ratio or χ^2
Hypnotic susceptibility (Aas)	33.6	29.8	26.8	8.3(++)
Myers-Briggs Type Indicator				
Extroversion-introversion*	96.3	98.7	103.1	0.6
Sensing-intuition	134.9	117.0	110.8	6.2(++)
Judgment-perception	119.1	102.4	87.6	7.6(++)
Thinking-feeling	97.7	90.3	87.2	1.4
MMPI T-scores				
F-scale	55.0	53.5	51.8	3.1(+)
Psychopathic deviate	58.2	52.7	51.1	3.2(+)
Hypomania	60.2	56.9	53.0	4.4(+)
Percent married	10	31	50	9.6(+)
Percent attending church	0	17	25	5.8
Percent who have tried marihuana	55	10	0	34.3(++)

* Scores below 100 are in the extroversion direction, those above 100 in the introversion direction, and similarly for the other three scales; (+) indicates significant beyond the 0.05 level; (++) indicates significant beyond the 0.005 level.

only casual knowledge. Fourteen percent expressed enthusiasm over the possibility of receiving LSD in the sense that they hoped to acquire personal insight or gain some other lasting benefit from the experience, 23% expressed concern over the safety of LSD. The remaining subjects were simply curious as to what the effects would be, and had no expectations of lasting effects, either beneficial or detrimental.

Of the 155 subjects, 34 were disqualified, six for previous experience with LSD or peyote, seven on the basis of psychosis in the immediate family, five who were currently in psychotherapy, and 16 because of interview impressions and doubtful MMPI profiles. Of those interviewed 14% had some experience with marihuana. However, this was not used as a basis for elimination. Of the 121 remaining, 25 withdrew from the experiment because of concern over the dangers of LSD. An additional 24 withdrew for various other reasons such as school or job load. These withdrawals were largely due to the interval (1 to 8 months) between the initial interview and the subject's participation in the main experiment.

Table 1 reveals some distinct differences among subjects with positive, neutral, and negative attitudes toward taking LSD. The positive group consisted of the six subjects with previous experience with peyote or LSD plus 14 who were enthusiastic about the prospect of receiving LSD. The neutral group reacted routinely to questions about expectations. The negative group was made up of the 25 who withdrew plus 11 who were rated as fearful but did not withdraw for this reason. Table 1 does not include the 28 persons disqualified for reasons other than previous use of peyote and LSD.

An analysis of variance shows that the three groups differ very significantly with respect to hypnotic susceptibility and also on two of the Myers-Briggs scales. The sensing-intuition scale contrasts the sensing person (LSD negative) who prefers conventional, factual, productive approaches with the intuitive type who prefers theory, ideas, and intuition. The judgement-perception scale contrasts the J-type (LSD negative) who likes his life well-structured, i.e., he plans, organizes, makes lists, and schedules his activities in a systematic, orderly fashion to avoid the casual, uncertain, spontaneous world preferred by the P-type.

Of the MMPI clinical scales, the F scale, the psychopathic deviate, and hypomania scales differentiated the three groups beyond the 5% level of confidence. In addition, the pro-LSD group had higher proportions of unmarried and non-church attenders than the other groups. Also, virtually all the students with marihuana experience were in the pro-LSD group.

MAIN TEST BATTERY

The battery was organized into four areas: anxiety, attitude and value, aesthetic sensitivity, and creativity, plus a fifth group of projective tests. It was administered in two sessions requiring about five hours total. Subjects were tested in pairs except for the Thematic Apperception Test (TAT), Holtzman Inkblot, and galvanic skin

response measures, which were given individually. The predrug tests were given the week prior to the first drug session. The battery was readministered at periods of two weeks and six months following the third drug session. About two thirds of the tests were given in alternate forms. The persons administering the tests did not participate in the conduct of the drug sessions or other parts of the experiment and had no personal experience with hallucinogens.

Anxiety Tests.—This group included two tests from Cattell's Objective-Analytic Anxiety Battery,[6] Susceptibility to Annoyance and Embarrassing Circumstances. Susceptibility to Annoyance measures the extent to which the subject states he would find various situations (e.g., crying children, traffic jams) annoying. Embarrassing Circumstances measures the extent of embarrassment felt in situations such as telling a joke at which no one laughs. The Holtzman anxiety scale was also in this group.

The galvanic skin response (GSR) to a series of mild psychological stressors was interpreted as another measure of anxiety. The measurements were made with zinc electrodes and zinc sulphate paste, using the method described in Wenger *et al.*[7] The skin resistance after five minutes was defined as the basal skin resistance. A set of stimuli was then presented on tape. The first consisted of a list of 20 words from Rapaport's word association list[8] read at 20-second intervals. Eight words were classified as traumatic (e.g., masturbate) and 12 as neutral (e.g., book). Subjects were asked to repeat words aloud. The second stimulus requested the subject to repeat a series of digit spans which started slightly beyond his ability (spans began at 8 digits and went to 10). The third stimulus requested the subject to give all the proper names he could think of ending in a given letter, such as "D." Both of these tasks were intended to produce embarrassment due to the subject's perceived poor performance. The digit span task was adapted from a similar measure used by Thetford.[9] The fourth stimulus involved mental arithmetic (continuing to add 8 to a given number). For the words, response was defined as the maximum rise in skin conductance during the six seconds after presentation. The responses to the other three stimuli were defined as the maximum rise in skin conductance during the interval from initial presentation until the end of the task.

Personality, Attitude, and Value Tests.—These tests were selected to measure those areas in which LSD-induced change is most frequently reported. Cattell's Severity of Judgement test[6] deals with the severity of judgement or punishment the subject would inflict for various infractions against legal or social authority. An expanded version of the Marlowe-Crowne Social Desirability Scale[10] (M-C) was made up of "items defined by behavior which are culturally sanctioned and approved, but which are improbable of occurrence" (e.g., I have never intensely disliked anyone). For the present purpose, it is interpreted as a measure of defensiveness or lack of accurate self-perception. An authoritarianism-dogmatism scale was constructed out of items from the California F scale,[11] Rokeach's Dogmatism test[10] and Levinson's Traditional Family Ideology scale.[14] It indicates a preference for "quiet receptivity, contemplation, and humble obedience," as opposed to "group action, progress through realism, and physical interaction" which is obtained by summing ways 9, 11, and 13 and the complements of ways 5, 6, and 12 (see Osgood *et al.*[15] for a factor analytic justification of this scoring).

Two special tests were constructed. The first consisted of a cardsort of 98 aphorisms which subjects placed into seven piles of 14 each on the basis of increasing meaningfulness, adapted, in part, from a similar test constructed by W. W. Harman at Stanford University. Four judges with extensive LSD experience predicted the aphorisms most likely and least likely to increase in meaningfulness subsequent to the administration of LSD. Aphorisms dealing with the importance of self-knowledge, overcoming egocentrism, mystical orientation, and a passive philosophy were generally scored positively by the judges. Aphorisms based on an active, materialistic, practical approach were scored negatively. The test-retest reliability for this test was 0.83.

The second test constructed for the present experiment was in the form of the semantic differential, using bipolar ratings of self and ideal self; for example: humble———: ———: ———: ———: ———: ———: ———proud. There were 38 such pairs, each rated for both self and ideal self. Three scores were obtained: (1) The sum of the absolute deviations from the middle, or neutral category; (2) a social desirability scale measuring the extent the subject rated self or ideal self in a socially desirable direction on pairs such as good-bad, sane-insane; and (3) an "LSD scale" made up of pairs such as lenient-severe, intuitive-rational, and laissez-faire-ambitious. The test-retest reliability for these three scales were 0.74, 0.86, and 0.70 for self, and 0.69, 0.66, and 0.68 for ideal self.

Aesthetic Sensitivity Tests.—Three art scales were administered. The scales measured the extent to which the subject's preferences agreed with those of artists and other art experts. The Bulley[16] test consisted of pairs of actual pictures of paintings, art objects, and architecture. The Graves Design Judgement[17] test was made up of pairs of designs. The Barron-Welsh[18] scale consisted of

designs which the subjects sorted according to "like" or "dislike."

A measure of artistic performance was based on the aesthetic ratings of the Draw-a-Person (DAP) drawings. The test-retest reliability for this measure was 0.78.

Creativity Tests.—Four tests from Guilfords' divergent thinking battery[19] were employed to measure fluency, flexibility, and originality. Associational Fluency involves the listing of words similar in meaning to a given word. Alternate Uses measures the ability to think of unusual uses for common objects. Hidden Figures consists of detecting figures obscured in complex designs, and Plot Titles requests the subject to list clever captions to one-paragraph stories. Also included was Mednick's Remote Associations[20] (e.g., What word is related to "surprise," "line" and "birthday"?). All of these tests were given in alternate forms at the three test sessions.

Two additional measures were obtained from the projective tests. The TAT stories were rated for originality and the DAP drawings for imaginativeness. Test-retest reliabilities were 0.69 and 0.49 respectively.

Projective Tests.—Four projective tests were utilized. Forms A and B of the Holtzman Inkblot[21] test were converted into three alternate forms of 30 cards each and administered in accord with the standard instructions. The TAT consisted of six cards repeated at each of the three testings (Cards 1, 2, 3BM, 6BM, 13MF, and 16). Standard instructions were employed. Fourteen cartoons from the Rosenzweig Picture-Frustration[22] test were utilized with the same set given at each testing. In the Draw-a-Person test, subjects were asked to "Draw a whole person"; and, on completion, to "Draw a whole person of the opposite sex."

PROCEDURE

Preparation of Subjects.—Following the initial administration of the main test battery, each subject received a one-hour interview with the clinical psychologist who attended the drug session. The psychologist attempted to establish rapport with the subject, allay anxiety, assure him that he would be well cared for, and that no surprises, tests, or other demands would be introduced during the drug session. Special effort was made to convey the notion that, for maximum comfort, he should adopt an attitude of relaxing and "going with" the drug effect, i.e., to passively observe the effect without trying to control or direct its course. Questions pertaining to safety of LSD were answered, but no mention was made of possible personality or other changes resulting from the experience. The experiment was double blind during the preparation and until that point in the drug session at which there were sufficient symptoms to identify the drug given.

Treatment Groups.—Seventy-two subjects participated in the main experiment (mean age 24, range 21 to 35). There were three treatment groups, each with 24 subjects. The experimental group received 200 micrograms of LSD, one control group received 20 mg. amphetamine (5 mg. immediate, and 15 mg. sustained release), and the other control group received 25 micrograms of LSD. Subjects were assigned to the groups on the basis of six matching variables: knowledge of hallucinogens; expectations (enthusiastic, neutral, fearful); experience with marihuana; hypnotic susceptibility score; sensing-intuition score; and judgement-perception score.

Conduct of Drug Session.—The first session was given in groups of two, the second and third in groups of four. There was no mixing of treatment groups within sessions and each subject received the same dosage at each of his three drug sessions. The drug sessions were held in a large, tastefully decorated room specially designed to enhance the drug experience. It contained couches, rugs, drapes, flowers, pictures, books, an aquarium, and art objects. Music was played during most of the session. The drug was administered by a physician at 8:00 a.m. The subjects were then asked to lie on the couch and listen to the music. They were provided with sleep shades, though their use was not required. The same clinical psychologist was in attendance for all sessions.

The psychologist sat in the background and did not initiate interaction unless subjects appeared to require support. The 200 microgram LSD group spent about 80% of the session day lying quietly on the couch. By comparison, the amphetamine and 25 microgram LSD groups both spent about 40% of the time lying quietly and the remainder talking or reading.

At 5:00 p.m. a graduate student took the subjects to dinner and then delivered them to their home, making sure each would be in the company of a friend during the evening. The subjects were given a sedative to take if needed on retiring, and were asked to fill out a check list of drug symptoms and write a subjective report on their experience that evening or the following day.

The main reason for using two control groups was the hope that the 25 microgram LSD group would experience sufficient auditory and visual changes to realize they had received LSD, and thus provide a more adequate control for prior expectations. In actuality, approximately the same proportion (25%) of amphetamine and 25 microgram LSD subjects thought that they possibly received LSD on one or more of their three sessions.

All 24 subjects in the amphetamine group finished the three drug sessions. In the 25 microgram LSD group, two subjects failed to complete the three sessions for reasons unrelated to the experiment. In the 200 microgram LSD group, six subjects withdrew after the first drug session and a seventh was terminated by the experimenter. Of the six who withdrew, three would probably have continued, had they not been influenced to withdraw by wives or friends. The other three withdrew because of frightening anxiety reactions. The subject terminated by the experimenter had a prolonged unrealistic reaction with some grandoise paranoid tendencies which slowly subsided. Subjects who withdrew or were terminated before completing the three drug sessions were given follow-up testing two weeks, and again, six months after their last drug session.

RESULTS

All 72 subjects completed the two-week follow-up testing. One each in the amphetamine and 25 microgram LSD groups did not complete the six month testing. There were no systematic differences between the amphetamine and 25 microgram LSD group test results, and they have been combined into a single control group for purposes of comparison with the 200 microgram LSD group. Tables 2, 4, 6, and 7 present the net difference between the mean change scores for the experimental and combined control group, i.e., [E(post drug) − E(predrug)] − [C(post drug) − C(predrug)]. The mean predrug test scores for the total sample (N = 72) are given in the left-hand column of Tables 2, 4, 6, and 7 to provide information on the magnitude of the changes.

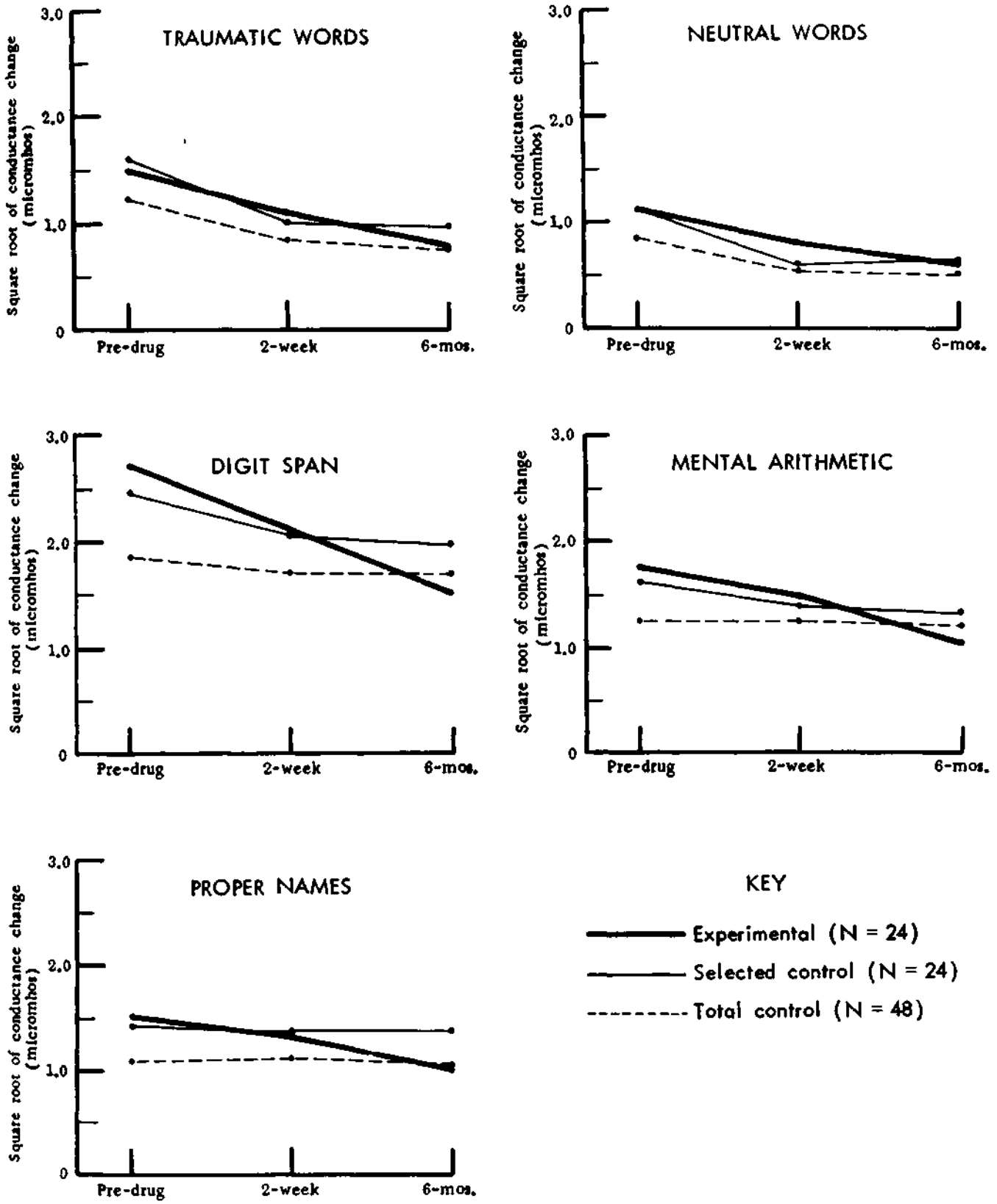
After the six-month follow-up testing was completed, a questionnaire was administered which dealt with the subject's own evaluation of the drug experiences and any lasting effects. In a summary evaluation (see Table 9), 14 of the 24 experimental subjects indicated that the drug sessions had produced some lasting effects. In Tables 2, 4, 6, and 7 the net difference between the mean change test scores for these 14 subjects and that for the combined control group is shown in parentheses. The *t*-ratios apply to the total experimental group. Where appropriate, the percentage of subjects in the three treatment groups who subjectively reported various specific changes is also provided along with the test results.

Anxiety Measures.—At the six-month testing, 33% of the 200 microgram LSD group subjectively reported lower anxiety and tension which they attributed to the drug experiences. The comparable percentages for the amphetamine and 25 microgram LSD groups were 13 and 9. The test results (Table 2) show virtually no change for the experimental group over that for the control group for the Annoyance test, and a small but insignificant drop for the Embarrassment test. Both of these tests showed a significant drop one week after LSD in an earlier pilot study.[3] The Holtzman anxiety scale shows an insignificant rise at two weeks and a similar drop at six months. There is no consistent difference between the net change for the 14 experimental subjects who themselves reported a drug-induced lasting effect (values

Table 2.—*Differences Between Predrug and Postdrug Measures of Anxiety and Stress*

Measure	Mean Prescore N = 72	Mean Net Change: 2 week $(E_2 - E_1)-(C_2 - C_1)$	t	6 month $(E_3 - E_1)-(C_3 - C_1)$	t
Annoyance	18.9	−0.06 (0.70)*	0.06	0.33 (0.89)	0.28
Embarrassment	14.2	−1.35 (−1.88)	1.57	−0.53 (−1.01)	0.54
Anxiety (Holtzman)	5.9	1.75 (2.00)	1.77	−0.98 (−1.66)	1.15
Basal skin conductance	7.8	1.78 (3.09)	1.50	0.22 (0.84)	0.18
Galvanic Skin Response†	N = 48				
Traumatic words	1.45	0.07	0.37	−0.14	0.75
Neutral words	1.03	0.04	0.28	−0.14	0.98
Digit span	2.57	−0.27	0.91	−0.70	2.35(+)‡
Proper names	1.39	−0.32	1.31	−0.50	2.05(+)
Mental arithmetic	1.66	−0.10	0.47	−0.35	1.64

* Numbers in parentheses are mean net change after deleting 10 experimental subjects who reported no lasting change.
† Units are square root of conductance change, measured in micromhos.
‡ (+) indicates significant beyond the 0.05 level of confidence.



Mean predrug and postdrug measures of GSR.

Table 3.—*Percent of Subjects Reporting Personality, Attitude, and Value Changes at Six Month Follow-Up*

Item	20 mg Amphetamine N = 23	25 μg LSD N = 23	200 μg LSD N = 24
Enhanced understanding of self and others	17	0	50
Greater introspection or reflectiveness	22	0	46
A tendency not to take myself so seriously	13	4	33
A greater tolerance toward those with opposing viewpoints	13	9	33
A less materialistic viewpoint toward life	4	0	29
A less egocentric viewpoint	4	0	12
Less competitive	4	0	17
Less easily disturbed by frustrating situations	9	0	38
More withdrawn	4	4	8
A tendency to feel depressed	0	0	0
More intense mood swings	4	0	21
A greater tendency to daydream	0	0	4
A feeling of greater detachment	4	4	25

in parentheses) versus the total experimental group.

The results for the GSR measures are shown in Table 2 and the Figure. A square-root transform was applied to the measures of response to correct for skewness. Analysis of covariance was then employed to adjust for correlation between the level of response prior to presentation of the stimuli and the size of the response. Five separate analyses of covariance were employed: the mean response to the eight traumatic words, the mean response to the 12 neutral words, and the responses to the other three stimuli.

The mean responses to the five stimuli are shown in Fig. 1. The mean response at the predrug testing tended to be substantially higher for the 200 microgram LSD group than for the combined control group. This was due to chance, since neither the subject nor the experimenter was aware of the treatment group assignment at the time of the predrug testing. The lack of agreement

Table 4.—*Differences Between Predrug and Postdrug Measures of Personality, Attitudes, and Values*

Measure	Mean Prescore N = 72	Mean Net Change: 2 week $(E_2 - E_1)-(C_2 - C_1)$	t	Mean Net Change: 6 month $(E_3 - E_1)-(C_3 - C_1)$	t	Predicted Direction
Severity of Judgment	43.7	−1.17 (−1.78)*	1.02	0.15 (−0.06)	0.14	−
M-C Social Desirability	6.3	−0.92 (−1.31)	1.44	−1.20 (−1.55)	1.82 (+)	−
Dogmatism	68.6	−0.58 (0.93)	0.23	3.98 (7.43)	1.42	−
Rosenzweig (constr res)	4.8	0.26 (0.64)	0.53	0.84 (1.24)	1.79 (+)	+
Aphorism test	267.2	5.89 (1.63)	1.27	7.04 (3.54)	1.29	+
Passivity (Ways-to-Live)	18.9	2.78 (4.07)	3.00 (++)	0.86 (1.43)	0.83	+
Semantic Differential						
Use of extremes (self)	47.5	−1.59 (−2.14)	0.78	−1.54 (−1.64)	0.61	−
Use of extremes (ideal)	55.6	−3.74 (−3.76)	1.23	−4.71 (−2.60)	1.50	−
Social desirability (self)	134.3	−2.19 (−5.73)	1.16	−3.63 (−4.14)	1.23	−
Social desirability (ideal)	155.1	−2.49 (−6.67)	0.98	−3.96 (−2.97)	1.46	−
LSD Scale (self)	89.6	1.38 (0.88)	0.70	0.83 (0.85)	0.46	+
LSD Scale (ideal)	92.6	3.19 (3.01)	1.57	0.56 (1.23)	0.30	+

* Numbers in parentheses are mean net change after deleting 10 experimental subjects who reported no lasting change; (+) indicates significant beyond the 0.05 level of confidence (one-tailed test); (++) indicates significant beyond the 0.01 level of confidence.

between the predrug levels of response in the experimental and control groups made the interpretation of the net difference between the predrug and post drug responses for the two groups ambiguous, since the results could have been due to the differences in predrug level of response, as well as to the drug effect. For this reason, the mean predrug response to the five stimuli was obtained for each of the 48 control subjects and the 24 subjects with the highest mean response (over all five stimuli) used to form a new control group (selected control). The figure shows the mean response prior to the covariance adjustment for the experimental and the two control groups. The data in Fig 1 are given prior to the covariance adjustment in order to compare the experimental means with the means for the two control groups. The adjusted data result in slightly different values for the experimental means, depending on which control is used in the covariance analysis. The mean predrug responses for the selected control group are fairly comparable to those for the experimental group.

Table 2 shows the net differences between the predrug and postdrug means for the experimental and selected control after the covariance adjustment. The net differences at the two week follow-up test are small and insignificant. At the six month testing, however, [E(postdrug) − E(predrug)] − [C(postdrug) − C(predrug)] is consistently negative for all five stimuli, and the values for the digit span and proper names task are significant beyond the 0.05 level of confidence. Thus, the GSR results at the six month follow-up tend to support the hypothesis that the experimental group will experience less emotional response to laboratory stress in the postdrug period. However, the two week results do not show a significant difference. In addition, there is no evidence that the experimental subjects who reported a drug-induced lasting change demonstrate a greater drop in GSR response than do those subjects who report no change. This is based on GSR responses prior to covariance adjustment.

Personality, Attitude, and Value Measures.—Table 3 shows the percent of subjects by treatment group who reported various changes at the six month follow-up. The instructions for this portion of the questionnaire read: "In the event you feel some changes have occurred in you as a result of your drug experiences, please check those items which are applicable. Check only those changes, if any, which have been maintained until the present time." Table 4 shows the net difference between the experimental and combined control groups for psychological tests intended to measure some of the variables covered by the questionnaire. The direction of change which is consistent with the hypothesis (and the questionnaire results) is shown in the right-hand column.

The direction of change for the test scores tends to agree with the subjective reports given in Table 3, but the magnitude of the changes is generally small. Considering the semantic differential results as a single test, seven out of seven test results change in the predicted direction at the two week follow-up, and five of seven at six months. The passivity measure is significantly higher beyond the 0.01 level of confidence at the two week testing, but the gain is not sustained at six months. At the six month test, the Marlowe-Crowne measure of social desirability (defensiveness) shows a significant drop, and the constructive response measure from the Rosenzweig Picture-Frustration test demonstrate a significant rise; both beyond the .05 level on a one-tailed test. The 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 situations. The results for the scales from the semantic differential test are all in the predicted direction, but none of the net changes is significant.

There is some tendency for the experimental subjects who subjectively report lasting effects to show larger test score changes in the predicted direction. However, this difference is not consistent throughout the battery.

Aesthetic Sensitivity.—The most frequently reported change in the experimental group on the six month questionnaire was "a greater appreciation of music" (62%). Forty-six percent responded similarly with respect to art. These subjective evaluations were supported by certain behavioral changes shown in Table 5. The increase in number of records bought, time spent in museums, and number of musical events attended in the postdrug period was significantly greater for the experimental group. The behavioral results are in response to

Table 5.—*Percent of Subjects Reporting Changes in Aesthetic Sensitivity and Behavior at Six-Month Follow-Up*

Item	20 mg Amphetamine N = 23	25 μg LSD N = 23	200 μg LSD N = 24
Greater appreciation of			
Music	9	4	62
Art	4	0	46
Bought more records	13	4	42
Spent more time in museums	26	22	50
Attended more musical events	9	9	42

Table 6.—*Differences Between Predrug and Postdrug Measures on Art Scales*

Measure	Mean Prescore N = 72	Mean Net Change: 2 week $(E_2 - E_1)-(C_2 - C_1)$	t	6 month $(E_3 - E_1)-(C_3 - C_1)$	t
Bulley Art Scale	15.1	0.68 (0.13)*	1.13	0.54 (1.05)	0.68
Graves Design Judgment	17.5	1.31 (1.31)	1.11	1.40 (1.65)	1.33
Barron-Welsh	48.6	4.64 (3.92)	0.83	−1.08 (−0.89)	0.21
Aesthetic Rating (DAP)	5.4	0.17 (−0.07)	0.63	−0.64 (−0.58)	2.43 (+)

* Numbers in parentheses are mean net change after deleting 10 experimental subjects who reported no lasting change; (+) indicates significant beyond the 0.05 level of confidence.

the question: "When comparing the nine months since your first drug session with the immediately previous period of the same length, have you bought (more, about the same, fewer) records, etc?" Results are simply in terms of behavior irrespective of whether it is attributed to the drug experience.

The results of the art tests are shown in Table 6. The four measures all show small, insignificant, net increases at the two week testing, but are inconsistent in direction at six months. The one significant change is a decrease in aesthetic rating of the DAP for the experimental group at the six month follow-up. Thus, the results of these art tests do not indicate that the increase in aesthetic appreciation and activities is accompanied by an increase in sensitivity and performance. There was also no difference between experimental subjects who reported lasting effects versus those who did not.

Creativity Measures.—At the six month testing, 24% of the 200 microgram LSD group felt that the drug experience had resulted in enhanced creativity in their work, as compared to 9% and 0% for the amphetamine and 25 microgram LSD groups respectively. Table 7 gives the results for seven measures of creativity. The results are equally divided in terms of change, and none is significant. The test of spontaneous flexibility (Alternate Uses) shows net increases for the experimental group which are significant beyond the 0.05 level for a one-tailed test at both the two week and six month follow-up. However, considering the lack of consistency in direction of change for the remainder of the tests, and the fact that an earlier pilot study[3] did not support a prediction of increase for the Alternate Uses test, a two-tailed test is considered more appropriate. Thus, these tests provide no evidence of increased creativity for the experimental group.

Projective Tests.—Because of space limitations, the projective test results can be presented only in brief summary form. The Holtzman Inkblot test was scored for the 22 standard scales.[21] There were no significant net changes at the two week testing. At six months, the experimental group showed significant net increases beyond the 0.05 level on the human and barrier scales.

Table 7.—*Differences Between Predrug and Postdrug Measures of Creativity*

Measure	Mean Prescore N = 72	Mean Net Change: 2 week $(E_2 - E_1)-(C_2 - C_1)$	t	6 month $(E_3 - E_1)-(C_3 - C_1)$	t
Associational fluency	10.9	−1.04 (−0.99)*	1.10	−1.02 (−0.83)	1.24
Alternate uses	9.4	1.23 (0.92)	1.80	1.36 (1.55)	1.93
Plot titles	10.4	−1.36 (−1.01)	1.44	0.07 (0.04)	0.08
Hidden figures	6.8	0.54 (0.65)	0.89	0.31 (0.81)	0.66
Remote associations	4.7	−0.04 (−0.26)	0.07	−0.33 (−0.90)	0.61
Originality (TAT)	2.6	−0.56 (−0.95)	1.27	−0.48 (−0.80)	0.93
Imaginativeness (DAP)	5.1	0.33 (0.17)	0.92	0.21 (−0.10)	0.61

* Numbers in parentheses are mean net change after deleting 10 experimental subjects who reported no lasting change.

The former also showed a near significant increase at the two week testing period. Since the number of significant changes are no more than would be expected for this number of scales, the results can only be considered as suggestive.

The TAT was scored for 16 variables which were selected to roughly parallel the personality factors measured by the tests in Table 4. The results show only insignificant changes lacking in any consistent pattern.

The constructive response score from the Rosenzweig Picture-Frustration test is listed in Table 4. Extrapunitive (E) and intropunitive (I) responses were scored in the standard manner.[22] The experimental group showed small net decreases in the postdrug testings on both of these scores.

Personality Correlates of Reactions to LSD.—The psychologist who attended the drug sessions ranked the 200 microgram LSD group on three dimensions: (1) overall impact or intensity of reaction; (2) integration and personal insight (as opposed to confused, defensive, or minimal reaction); and (3) extent to which the subject was anxious or threatened by the experience. The rankings were made without knowledge of test results and were based on the attendant's observations during the session, and the symptom check list and subjective report provided by the subject.

Table 8 shows some of the correlations between these rankings and the test scores. Also shown are the correlations between the tests and the sum of the subject-reported drug symptoms, as well as the subjective reports of lasting effect obtained after the six month follow-up. The latter are based on a point-biserial correlation, with the experimental subjects dichotomized into groups of 10 and 14, as shown in Table 9. The correlations between immediate drug reaction and reports of lasting effect (not shown in Table 8) are: drug symptoms, 0.36; impact, 0.46; insight, 0.65; and threat, 0.00.

The results for the hypnotic susceptibility test and the Myers-Briggs sensing-intuition and judgement-perception scales are consistent with those shown in Table 1. These scales differentiate persons with positive,

Table 8.—*Personality Correlates of LSD Reactions (200 μg Group)*

Measure	Drug Symptoms	Impact	Insight	Threat	Lasting Effect
Hypnotic Susceptibility (Aas)	0.50 (+)	0.53 (++)	0.16	0.22	0.18
Myers-Briggs Type Indicator					
Extroversion-introversion	−0.43 (+)	−0.14	−0.31	0.05	−0.25
Sensing-intuition	0.39	0.38	0.35	−0.13	0.41 (+)
Judgment-perception	0.06	0.51 (+)	0.26	0.18	0.25
Thinking-feeling	0.00	0.07	−0.02	0.01	0.06
Composite (S-N, J-P, Aas)*	0.40 (+)	0.59 (++)	0.35	0.06	0.35
Imaginativeness (DAP)	0.40 (+)	0.35	0.27	0.13	0.34
Aphorism Test	0.31	0.40 (+)	0.44 (+)	−0.08	0.54 (++)
Passivity (Ways-to-Live)	0.43 (+)	0.32	0.28	−0.04	0.37
Semantic Differential (Ext-Self)	−0.29	−0.39	0.10	−0.58 (++)	0.00
Severity of Judgment	−0.40 (+)	−0.58 (++)	0.18	−0.41 (+)	−0.25
Dogmatism	−0.25	−0.36	−0.30	−0.13	−0.33
TAT Scales					
Active aggression	−0.56 (++)	−0.32	−0.21	−0.07	−0.31
Achievement competition	−0.35	−0.44 (+)	−0.36	−0.29	−0.30
Following instructions	−0.07	−0.04	−0.33	0.05	−0.44 (+)
Organization	−0.05	0.08	−0.40 (+)	0.15	−0.41 (+)
GSR Response					
Traumatic words	0.00	−0.40 (+)	−0.07	−0.36	−0.19
Neutral words	0.01	−0.35	−0.08	−0.37	−0.19
Digit span	0.02	−0.42 (+)	−0.03	−0.40 (+)	−0.22
Proper names	−0.33	−0.34	−0.27	−0.11	−0.38
Mental arithmetic	−0.23	−0.42 (+)	−0.17	−0.21	−0.32

* Obtained by summing the ranks for the sensing-intuition, judgment-perception and hypnotic susceptibility measures; (+) indicates significant beyond the 0.05 level of confidence; (++) indicates significant beyond the 0.01 level of confidence.

neutral, and negative attitudes toward taking LSD and they are also positively correlated with intensity of the drug reaction. Persons tend to react more strongly to LSD who report naturally occurring hypnotic-like experiences, are oriented toward ideas and intuition, and prefer to live an unstructured life. Those who prefer a more practical and orderly life tend to have less intense reactions.

The DAP rating of imaginativeness, aphorism test, and a passivity score derived from the Morris' Ways-to-Live test correlate positively with intensity of LSD reactions, and also with subjective reports of lasting effect. The latter two measure preference for a reflective, self-understanding, nonegocentric value orientation.

The use of extremes for self-description in the semantic differential, the severity of judgement and the dogmatism tests tend to be negatively correlated with intensity of LSD reaction. These tests measure rigidity and a preference for a controlled, well-defined environment. Persons scoring high on these measures tend to limit both the impact and the threatening aspects of the LSD experience.

The active aggression and achievement-competition scales from the TAT correlate negatively with the LSD reaction as do following instructions and organization. These results are in accord with those for the Ways-to-Live and Myers-Briggs tests. Aggression, competition, and a preference for structure and conformity are negatively related to the LSD reaction.

Finally, the GSR response to psychological stressors tends to be negatively correlated with the magnitude of the LSD response.

Subjective Evaluations.—The data reported in Table 9 are the results of the subject's summary appraisal of the drug experiences and their effects. Of the 24 experimental subjects, the number reporting no effects, moderate, and pronounced lasting effects were 10, 10, and 4. The comparable results for the amphetamine and 25 microgram LSD groups were 20, 3, 0, and 23, 0, 0 respectively.

As mentioned earlier, one of the matching variables used in the treatment group assignment was expectation or motivation. Five of the 24 subjects in the experimental group were rated as enthusiastic over the prospects of receiving LSD, in the sense that they hoped to derive some benefit from the experience. Two of these were among the four subjects who reported pronounced lasting effects at the six month follow-up. Two others reported moderate effect and one no lasting effect. Of the three amphetamine subjects who reported moderate lasting effect, one was rated as enthusiastic in terms of motivation.

During the interview following the six month testing, subjects were asked to rank their first, second, and third drug session in terms of overall impact. Of the 17 experimental subjects who completed more than one session, the number ranking the first, second, and third session as most impressive were 10, 3, and 4 respectively. Five of the seven rating the second or third session highest were among the 14 who reported some lasting effect.

CONCLUSION

The results pertaining to the difference between the predrug and post drug test scores should be considered as exploratory in nature. The number of statistically significant differences between the experimental and control groups are not grossly inconsistent with the

Table 9.—*Summary Appraisal of Drug Experiences at Six Month Follow-Up (%)*

Item	20 mg Amphetamine N = 23	25 μg LSD N = 23	200 μg LSD N = 24
Best single description of drug experiences			
Boring	0	9	0
Pleasant but otherwise uneventful	57	78	4
A rather interesting experience	30	13	17
A very dramatic and interesting experience	13	0	71
Unpleasant and disturbing	0	0	8
Best Single Description of After-Effects			
No particular effects during or after	39	65	0
Interesting at the time, but no lasting effect	30	30	21
Apparent changes shortly after, but effects rapidly disappeared	17	4	21
Some lasting effects	13	0	42
Pronounced lasting effect on personality	0	0	17

hypothesis that they arose from chance, considering that 22 tests were administered, some of which had multiple subscales, and all tests yielded different scores.

One of the more suggestive results is the significant drop in the galvanic skin response to stress situations for the experimental group at the six month testing. This finding is especially interesting, since it is a physiological measure, and therefore more suitable for experimental control than are many of the psychological tests.

The postdrug results for the personality, attitude, and value tests are generally consistent with the hypothesis, as well as the subjective reports of change, although the amounts of change are typically quite small. There is some evidence of a more introspective and passive orientation accompanied by a less defensive attitude in the experimental group. The subjective reports of increase in aesthetic appreciation were supported by behavioral activities, but there was no evidence of enhanced performance on the art tests. Similarly, there was no tendency for improvement in the postdrug measures of creativity.

The findings relating personality variables to attitude toward, and response to, the taking of LSD are much more definite. As would be expected, persons who place strong emphasis on structure and control generally have no taste for the experience and tend to respond minimally if exposed. Those who respond intensely tend to prefer a more unstructured, spontaneous, inward-turning (though not socially introverted) life, and score somewhat higher on tests of aesthetic sensitivity and imaginativeness. They also tend to be less aggressive, less competitive, and less conforming.

The above results should be interpreted in the context of the population from which the subjects were drawn. They were graduate students committed to a well-defined goal, and were typically not motivated to take LSD, nor to alter their values or aspirations. They received the drug in a secure, aesthetically pleasing setting, but without suggestions of possible lasting effect. Under these conditions, 58% of the experimental group subjectively reported some lasting effect after six months. However, attempts to measure these changes via psychological tests provided only minimal supportive evidence.

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