

THE EFFECT OF LSD ON THE ASSOCIATIVE PROCESSES

WALTER WEINTRAUB, M.D.,¹ ARTHUR B. SILVERSTEIN, Ph.D.¹
AND GERALD D. KLEE, M.D.¹

Although lysergic acid diethylamide (LSD) has been widely hailed as an important experimental tool in the investigation of the so-called functional psychoses, the psychological nature of the LSD "model psychosis" remains shrouded in mystery. Different workers hold sharply conflicting views concerning its possible relation to endogenous psychotic disorders, and even such crucial problems as the relationship of dose to LSD response and the influence of the subject's personality on his reaction to the drug have received little systematic attention.

An interdisciplinary research team at the Psychiatric Institute of the University of Maryland has been studying some of these important issues. In a recent paper, two of the authors have attempted to show to what extent the development of paranoid reactions in LSD subjects may depend upon certain very specific personality traits, and how this knowledge can help in predicting which subjects are most likely to develop such reactions (1).

It is clear that the typical LSD subject suffers impairment of a number of ego functions. Perceptual distortions are frequent, the ability to concentrate is affected, there are strange feelings of depersonalization, etc. Up to now, however, there have been relatively few attempts to compare systematically the responses of LSD subjects with those of normal controls and psychiatric patients on psychological tests specifically designed to assess ego functioning. This paper describes an attempt to attack

this problem by administering the word association test (WAT) used by Rapaport, Gill, and Schafer (2) to 25 LSD subjects and an equal number of controls. In addition to comparing the responses of these two groups with each other, we shall attempt to compare the results of the LSD subjects with the schizophrenic, depressive, and neurotic patients and the control subjects studied by Rapaport *et al.*, keeping in mind, of course, that the groups were not equated for such critical factors as age, sex, and intelligence. Eventually, we hope to collect data on a sufficient number of schizophrenics to make a more rigorous comparison.

Before presenting the results of the experiment, a brief description of the WAT is in order. The test consists of two parts: in the first part, the subject is instructed to respond quickly with the first word that comes to his mind after hearing each of 60 stimulus-words. The examiner records and times the responses. In the second part of the test, the words are read again and the subject is asked to give the same responses that he gave the first time; all reproduction failures as well as delayed reaction times are noted.

In scoring the reactions, an adequate response is considered to be one which is related to the stimulus in a conventional way and which tends to be at the same conceptual level, *e.g.*, *table-chair*, *dog-cat*, etc. Pathological responses vary from serious ones such as blocking, repetition of the stimulus, and clang associations to relatively minor deviations such as the use of proper nouns, self-references, *e.g.*, *doctor-my father*, and phrase completions, *e.g.*, *lamp-shade*.

In treating the data, we have followed,

¹ The Psychiatric Institute, University of Maryland School of Medicine, Baltimore. The authors wish to express their gratitude to Dr. David Rapaport, who, after reading a preliminary version of this paper, discussed with us some of the theoretical implications of our findings.

for purposes of comparison, the example of Rapaport *et al.* in making the following distinctions:

1) Responses to traumatic vs. those to nontraumatic stimuli. Of the 60 stimuli, 20 are considered to be "traumatic". They include such words as *breast*, *masturbate* and *mother*, whereas the nontraumatic stimuli consist of more neutral words, as *chair*, *screen* and *farm*.

2) Serious vs. minor deviations (examples of both have been given above).

3) Close vs. distant reactions. In order to understand this distinction it is necessary to outline the conception of the associative process offered by Rapaport *et al.* They regard this process as having two phases: an analytic phase, in which the stimulus is "broken down" into its subjective components, and a synthetic phase, in which an acceptable response is "built up" from the thoughts or images aroused by the stimulus.

Close reactions are believed to occur because of difficulties in the analytic phase. The associations do not seem to depart sufficiently from the stimuli and tend either to complete or to define the stimulus words. The more pathological reactions in this category include definitions, clang associations and repetitions.

Distant reactions are believed to be due to difficulties in the synthetic phase. There appears to be little or no connection, conceptually or otherwise, between the stimulus and the response, *e.g.*, *daughter-village*.

METHOD

Because individuals vary so greatly in their reactions to LSD, it is highly desirable that whenever possible subjects should act as their own controls. The experiment was originally designed in this way, but pilot studies made it clear that there is a marked "practice" effect when the WAT is administered to the same subject more than once. Subjects tend to have more popular responses and fewer association dis-

turbances on the second testing, and, in order to investigate this effect, a separate study was undertaken, the results of which will soon be ready for publication.

In the present study, 50 young male adult volunteers were screened, by means of psychiatric interviews and psychological tests, in order to rule out serious psychopathology. The subjects were divided at random into two groups of equal size, one of which received 2 gamma/kilo LSD orally. One and a half hours after the drug was given, the WAT was administered. The subjects in the second group acted as controls. Each test record was scored by two judges and the overall percentage of scoring agreements for the 3,000 responses was 91.0 per cent (81.8 per cent excluding popular reactions, for which the scoring is objective).

RESULTS

Popular Reactions. The "popular reaction-words" listed by Rapaport *et al.* are those given by at least 10 of their 151 clinical and control cases. Although our records indicate differences in the comparative frequencies of certain adequate responses, we have, nevertheless, followed their list for purposes of comparison. According to Rapaport *et al.*, the proportion of popular responses decreases with increasing psychopathology. Their figures for the mean percentage of popular reactions in the various groups tested were: schizophrenics and depressives, 43.2 per cent; neurotics, 52.9 per cent and controls, 60.0 per cent. In the present study the means are 56.8 per cent for the control group and 47.4 per cent for the LSD subjects. This difference is significant at the 0.01 level ($t = 3.35$). The LSD group falls about midway between the psychotic and neurotic groups studied by Rapaport *et al.*, but we do not attach much significance to this quantitative difference. In comparing the reactions of the LSD subjects to the clinical cases of Rapaport *et al.*, we shall be particularly concerned with qualitative differences, since the degree of change

is probably closely associated with the dose of LSD administered.

Traumatic and Nontraumatic Stimuli. The data for total association disturbances show a highly significant difference between the control and LSD groups (see Table 1). This overall difference, of course, was to be expected.

It is noteworthy that although the LSD group has a somewhat higher number of errors on the traumatic words than the control group, this difference is not significant, whereas the difference between the two groups in the number of abnormal responses to the nontraumatic words is highly significant. The data were checked to see whether this result might be due to the fact that some of the nontraumatic words had become "traumatic" under the conditions of the experiment, thus receiving a disproportionate share of pathological responses. The statistical analysis showed that this was not the case.

Rapaport *et al.* found that in both their control and clinical groups the percentage of disturbances was significantly greater on the traumatic than on the nontraumatic stimulus words. Our results show a sharply contrasting picture. The control group does follow the general pattern described by Rapaport *et al.*, but the difference between the percentage of disturbances on traumatic and nontraumatic stimuli for the LSD subjects is not significant.

Reaction Time Disturbances. The data for reaction time reveal a significant difference between the LSD and control groups (see Table 2). It is interesting to note that once again the difference between the two groups is due primarily to their reactions to the nontraumatic stimuli. The difference in the mean reaction time on the traumatic words is not significant; for the nontraumatic words, the difference is significant. Looking at the data in another way, the LSD subjects show in their reaction times, as they do in their association disturbances, some tendency to abolish the differential re-

TABLE 1
Association Disturbances on Traumatic and Nontraumatic Stimuli Under Control and Drug Conditions (For each group, N = 25)

Type of Stimulus	Control Mean	Drug Mean	t	P
Traumatic (20 words)	3.3 (16.4%)	4.2 (20.8%)	1.31	ns
Nontraumatic (40 words)	4.4 (11.1%)	8.1 (20.2%)	3.79	<.001
t	3.45	0.86		
P	<.01	ns		
All Stimuli	7.7	12.2	3.37	<.001

TABLE 2
Reaction Times on Traumatic and Nontraumatic Stimuli Under Control and Drug Conditions (For each group, N = 25)

Type of Stimulus	Control Mean	Drug Mean	t	P
Traumatic (20 words)	3.0"	3.2"	0.70	ns
Nontraumatic (40 words)	2.3"	2.7"	2.93	<.01
t	3.56	2.54		
P	<.01	<.05		
All Stimuli	2.4"	2.8"	2.50	<.05

TABLE 3
Serious and Minor Deviations Under Control and Drug Conditions (For each group, N = 25)

Type of Deviation	Control Mean	Drug Mean	t	P
Serious	2.4	6.2	3.21	<.01
Minor	5.3	6.0	0.77	ns

sponse to traumatic and nontraumatic stimuli which is characteristic of the control group. Rapaport *et al.* found that both their clinical and control groups did react differentially to traumatic and nontraumatic stimuli.

Serious and Minor Deviations. It may be of interest to note that the tendency to make serious deviations is significantly greater in the LSD group than among the controls (see Table 3). On the other hand, the difference between the two groups in the mean number of minor deviations is not significant. This parallels the finding of Rapaport

TABLE 4
Close and Distant Reactions Under Control and Drug Conditions (For each group, N = 25)

Type of Reaction	Control Mean	Drug Mean	<i>t</i>	P
Close	2.1	4.7	2.95	<.01
Distant	2.4	3.2	1.11	ns

TABLE 5
Serious and Minor Reproduction Disturbances Under Control and Drug Conditions (For each group, N = 25)

Type of Disturbance	Control Mean	Drug Mean	<i>t</i>	P
Serious	5.5	9.4	2.97	<.01
Minor	4.5	6.0	1.63	ns
All Disturbances	10.0	15.4	3.44	<.01

and his associates, that a relative increase in serious deviations accompanied an increase in psychopathology.

Close and Distant Reactions. According to Rapaport *et al.*, the incidence of both close and distant reactions was greater in their neurotic and psychotic groups than in their control group. However, they reported a significant difference in the relative increase of the two types of reactions in the various diagnostic categories. Thus a marked increase in close reactions was characteristic of depressive patients whereas schizophrenics tended to accumulate distant reactions. Neurotics, too, characteristically had a greater increase in distant reactions, although to a lesser extent than the schizophrenics.

The results of the present study are recorded in Table 4, which shows that the LSD subjects gave a considerably greater number of close reactions than the controls. This is not true of the distant reactions, where the number of errors, although greater in the LSD group, is not significantly so.

Reproduction Disturbances. Rapaport *et al.*, divide reproduction disturbances into two groups: serious deviations, which include unrelated false reproductions, failures

to reproduce and long delays of correct reproductions; and minor deviations, which include related false reproductions, corrected false reproductions and partially correct reproductions. They found that the number of reproduction disturbances was proportionate to the degree of psychopathology, and that this was especially true for serious deviations.

Our results fully bear this out. Table 5 shows that in total reproduction disturbances, the LSD group significantly exceeds the control group. However, this difference is almost entirely in the category of serious deviations. In the case of minor deviations, the difference between the two groups is not significant.

DISCUSSION

To summarize the principal findings of the study: As compared with normals, LSD subjects make more errors, have fewer popular responses and react more slowly. In addition, close reactions predominate, as do serious deviations and the differential reaction to traumatic and nontraumatic stimuli is abolished.

In comparing these results with those for the clinical groups studied by Rapaport *et al.*, we see that the LSD responses form a pattern quite distinct from that of any of the endogenous disorders. In two major respects, the preponderance of close reactions and the abolition of the differential response to traumatic and nontraumatic stimuli, the LSD subjects differ from all the clinical groups. It is true that the depressive group of Rapaport and his co-workers also showed a great increase in close reactions, but this was accompanied by a substantial increase in distant reactions. In this connection, it is interesting to note that Woodrow and Lowell (3) administered a word association test to 1,000 children, aged 9-12, and found that there was a tendency for their subjects to complete or enlarge upon the idea conveyed by the stimulus rather than to give a related, parallel response.

How can we explain the puzzling tendency of the LSD subjects to react nondifferentially to traumatic and nontraumatic stimuli? The crux of the matter is that they make no more errors on traumatic words than do the controls, despite the fact that the overall responses prove that their associative processes are significantly disturbed. We know from their reactions that the words are heard and understood by the subjects and yet they have no more effect than the more neutral stimuli. We have numerous examples of how subjects under LSD actually responded more adequately to certain charged words than they did under nondrug conditions. One subject, for example, gave as a response to the stimulus word *penis* the association *peter* under the influence of LSD and a *man's organ* under control conditions. Another volunteer offered *sexual* as a response to *intercourse* under drug conditions and gave *affairs with a woman* in the control part of the experiment. In both these illustrations, the control responses are clearly inadequate by the standards of Rapaport *et al.*, since they are multiword definitions rather than conceptually equivalent, one-word associations. Under drug conditions the responses are better but in the first case, a vulgar word is used, and in the second case, what is probably a more emotionally charged word is used.

There has been a certain amount of speculation concerning the impact of LSD on the "repressive barrier," and certainly one would expect that any such effect would influence the way LSD subjects would react to charged and noncharged stimuli.

From the ego-psychological point of view, the conventional responses, which are given quickly and automatically, can be viewed as representatives of what Hartman calls the conflict-free area of the ego. In normal individuals, the great majority of nontraumatic stimuli can be handled in this automatic way without serious interference from unconscious influences. Traumatic stimuli are much more likely to impinge on con-

flictual areas and, therefore, to elicit slower, more deviant responses. In the case of neurotics and especially psychotic patients, the conflict-free area of the ego is narrowed, but, nevertheless, is still comparable to what we find in normal subjects. It is likely that LSD in hallucinogenic doses succeeds somehow in dissolving the boundaries between the autonomous and conflictual areas of the ego. Obviously, we have only placed an observed phenomenon in a convenient frame of reference, without attempting to answer the question of how this change in the ego comes about.

One final question which merits brief comment is the problem of dosage in LSD experiments. As was mentioned above, the degree of abnormality on any test using LSD subjects will tend to increase with dose. It has even been suggested that the LSD reaction changes qualitatively with increasing dose, and, if this should prove to be so, the conclusions drawn from the data of this study may have to be qualified. Up to now, however, no convincing evidence has been put forward to indicate that altering the dose of LSD will actually change the nature of the reaction in any significant way. Lowering the dose will bring the subject closer to normality, not to schizophrenia.

SUMMARY

1. The responses of 25 LSD subjects to the word association test employed by Rapaport, Gill and Schafer have been compared to those of a control group and to the responses given by groups of schizophrenic, depressive, and neurotic patients tested by Rapaport *et al.*

2. Our analysis shows that in the associative processes, at least, the LSD reaction does not closely approximate any of the principal "functional" psychiatric disorders.

3. Probably the most striking way in which the LSD reaction differs from all other conditions is the abolition of the differential response to traumatic and nontrau-

matic stimuli. We have attempted to place this phenomenon within the framework of modern ego-psychology theory.

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