

Progression of Effects of Lysergic Acid Diethylamide [LSD]

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Introduction

Since the Swiss chemist Hoffman, on April 16, 1943, accidentally discovered the mental effects of lysergic acid diethylamide (LSD-25), a great many experiments with the drug have been reported in various journals. Observations show most agreement in the area of physical subjective symptoms and unreality and least agreement in changes of mood and behavior.

Tremor, nausea, dilation of pupils, perspiration, and changes in blood pressure have been consistently found. The observed mental effects have been more at variance. Busch and Johnson,¹ interested in LSD-25 as a possible therapeutic agent, have found it to cause increased activity, exhibition of emotion, and expression of psychopathology, with only short periods of confusion and occasional visual hallucinations. Similarly, Sandison, Spencer, and Whitelaw² emphasize reliving of repressed personal experiences resulting from nonselective disturbance of the unconscious. Savage,³ in a clinical psychological study, has found the mood to be one of aggrandizement, omnipotence, and euphoria with hallucinations frequent, while in a later analytic study⁴ he emphasizes hallucinations and ego disturbances, suggesting that loss of ego feeling progresses from legs and genitals to arms and trunk, affecting the face and lips (first to be in-

cluded in the ego) last. Hoch, Cattell, and Pennes,⁵ comparing the effects of mescaline and lysergic acid on three groups of patients, report a wider variety of changes than other authors as effects of LSD, finding perceptual alteration in the foreground with visual illusions and hallucinations very common. Although there is a tendency to disinhibition and increased psychomotor activity, there is also found a comfortable lassitude and sedative effect. These authors found that the emotionality of the reaction varied with their three groups, being most intense with pseudo-neurotic schizophrenics and least intense with deteriorated schizophrenics.

DeShon, Rinkel, and Solomon,⁶ doing a complete psychiatric assessment and working with normals, found that indifference and blunting were protracted, with suspiciousness and hostility transient, that behavior was characterized chiefly by underactivity and lack of spontaneity, that disturbances of perception were mostly of the illusionary type, and that depersonalization, as well as hallucinations, when present, was closely related to feelings of unreality.

Noting the inconsistencies and lack of agreement, Abramson and associates⁷ investigated statistically the answers of normal subjects to a list of symptoms. They report that there are significant increases in the number of normal subjects responding with zero, 50% and 100% of LSD. The authors add the suggestion that the subjective quality of a symptom with 100% may well be different from that of the same symptom reported with placebo.

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Among the diverse reports, some writers have conceptualized the effects of LSD and related drugs by invoking ego psychology. Thus, Lindemann and Clarke,⁸ on the assumption that drugs produce changes in the integrative functions of the ego, go on to enumerate the changes caused by different drugs. Personality has not been systematically explored as a variable in reaction to the same drug, but has been alluded to by Hoch,⁵ who found differences in the reactions of his patient groups, and by Savage,³ who points out that distortions of reality may be accompanied by either euphoria or anxiety.

In general, we say that the discrepancies in observation are not surprising, considering that the reports on LSD refer to patients as well as normals, and to different doses of the same drug and that they are fitted into different conceptual frameworks for economical purposes. The dosage factor may partially account for the lack of agreement in general, and specifically for the findings of Sloane and Lovett Doust⁹ of no measurable impairment or change in several psychological functions. They administered only 40 γ to their normal subjects, whereas in the Boston Psychopathic Hospital⁶ and Mount Sinai Hospital⁷ reports of positive findings larger doses were used.

Moreover, the importance of the attitude of the experimenter and of other people interacting with the subject tends to be consistently minimized. Hyde¹⁰ has shown that the affective interplay of subjects and experimenters has a mirror effect: that the strong affective relationships of hostility and affiliation are distorted much more frequently than the impersonal, empathic, and nurturant interplay, and, further, that qualitatively the type of distortion corresponds to the

type of affect. Bockoven,* stimulated by Hyde's findings and attempting a comprehensive search for the effects of LSD, has stated that when the results are studied from the larger perspective of social psychology scarcely any specific psychological effects can be identified which cannot be better accounted for in terms of social factors.

The preceding review demonstrates the existing need for a clearer documentation of the LSD syndrome. Clinical evaluation without agreement as to the categories or functions to be evaluated plus lack of definitions lead to apparently discrepant observations, on the one hand, while the perspective of social psychology, dealing with the multiplicities of interpersonal relations, tends to confound the direct effects of the drug by absorption into the social matrix. On the basis of our experiments, it is felt that differences in dosage and phase of the LSD reaction observed account for many of the discrepancies. The purpose of this paper is to identify a progression of phases in the LSD reaction at our standard dose level.† Through this, it will be seen that certain apparent discrepancies in the comparison of other studies may be reevaluated.

Method

The literature is in general agreement that the subject reports symptoms within 30 minutes after ingestion of LSD-25 and that cessation occurs within 12 hours. De-Shon⁶ and associates describe three major phases, lasting 12 to 16 hours, and a fourth phase, of mild after-effects, lasting for several days. The first phase was the period of administration of the drug to the height of the reaction. The second phase was the height of the reaction.

* Bockoven, J. S.: Effects of Social Situations on the Quality of Interpersonal Relations and Symptom Intensity in Lysergic Acid Psychosis, 1953 Annual Report to Geschickter Foundation.

† Our standard dose is 1 γ per kilogram of body weight.

lying within a time span of one to five hours, and the third phase, the period from the end of the height of the reaction until evening, was characterized by reduced activity, poverty of thought, indifference, and flat affect. The height of the reaction occurring rarely after five hours, onset, peak, and decline are included in the present observations by listing symptoms for a period of eight hours.

The data used in this study were the observer's notes. During the experimental day, the subject was accompanied by a trained observer, who recorded, verbatim, the subject's conversation with others, his facial expression, posture, and motor responses. The protocols used were those of the first 20 experiments on 18 normal subjects receiving 1γ per kilogram of body weight. Symptoms were classified from the observer's protocols for each hour of the eight-hour period according to the criteria of peculiarity, intensity, duration, and frequency.

Having been impressed by the penchant of LSD experimenters to use "objective" techniques and categories and to concentrate on hallucinations, delusions, depersonalization, and other pathological segments, we decided to define our symptom groups in terms of the bipolar relation of subject and environment, thus not precluding "normal" behavior from our results. Our symptom groups, with their rationale, follow:

1. Gregariousness: verbalized sexual desire, elation, friendliness, giddiness—intoxication symptoms which dissipate subject's affect into acceptable social channels
2. Anxiety and Apprehension: symptoms of affective quality wherein the subject contains his affect
3. Irritation and Hostility: symptoms which mediate communication of subject's affect to his environment
4. Neuromuscular symptoms: heaviness, restlessness, tenseness, weakness, tremulousness, fatigue
5. Cutaneous symptoms: perspiration, cold, warmth, numbness, tingling, and dizziness

6. Apathy: apathy, depression, indifference, lethargy, seclusiveness, disinclination to talk, lassitude—symptoms indicating that expression of affect is not overtly sought
7. Confusion of Thought: tearfulness, suspiciousness, perplexity, ambivalence—severe, subjectively incapacitating symptoms
8. Perceptual Distortion: visual misperception of the environment, especially of other people
9. Unreality: inexplicable pervasive feelings of strangeness, accompanied by acceleration or cessation of time, loss of reality, in some subjects exacerbated by anxiety
10. Inappropriate Laughter and Smiling: inadvertent communication to the environment of involuntary affect

Equivalence; Disparity; Apology

In presenting our results, we are faced with the possibility of either recording the number of symptoms in each category or indicating the hour of maximal symptoms for a category as a norm and the remaining hours as percentages of the maximum. We chose the latter course. The rationale for such presentation stems from the disparity of number and type of symptoms in the various groups, which, when plotted by number alone, would give the impression of physical dysfunction as the main action of LSD. While Neuromuscular and Cutaneous symptoms would seem paramount in the symptom picture, Unreality and Perceptual Distortion would appear to be of minor importance when only numerical incidences are considered. The latter symptoms, however, are among the most unique reactions caused by the drug. A symptom entered under Unreality must be of relatively protracted duration and would be entered only once in a time period; those of the physical type are often momentary and usually have several entries in a time period. By representing the frequency of each category of symptoms in any hour as a percentage of the frequency in a maximal hour, we relate the frequency of each symptom hour to its own norm and, at the same

PROGRESSION OF LSD EFFECTS

time, provide a quantitative basis for comparison with other symptoms.

Results

Gregariousness (Fig. 1), a "normal" and acceptable outlet, is at a maximum during the first hour after the ingestion of LSD. It declines slowly but steadily until the fifth hour, before it rises in

the third and fourth hours, at which time the effects of LSD are felt most intensively by the subjects.† Here it must be noted that this symptom group denotes an unpleasant affect, of which the subject has awareness. It is of significance, then, that awareness of Anxiety and Apprehension is marked in the first hour, when LSD effects are neither very

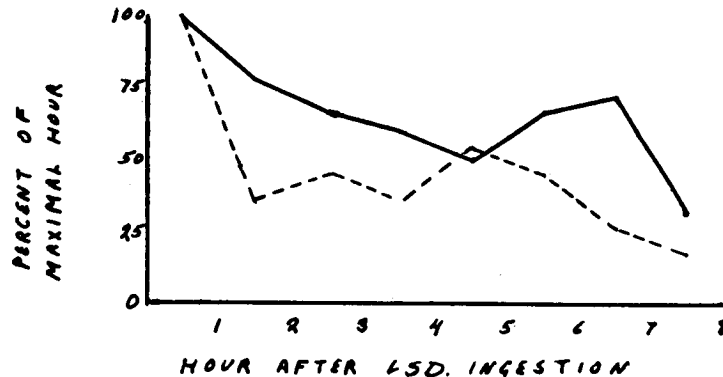
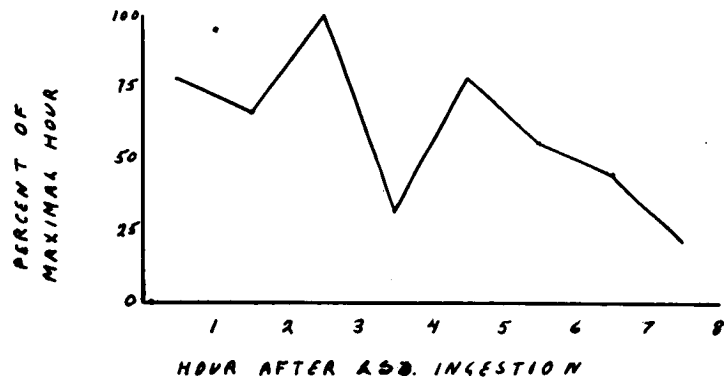


Fig. 1.—Gregariousness (solid line), and anxiety and appreciation (broken line).

Fig. 2.—Hostility.



the sixth and seventh hours. This type of expression does not fall below 50% of maximum, indicating that even under the most unusual of stresses some subjects are still able to channel some energy into appropriate outlets.

The syndrome of Anxiety and Apprehension (Fig. 1) is similar to Gregariousness insofar as it has its peak in the first hour. The drop in the second hour, however, is marked and remains low in

noticeable nor very marked. There is a slight tendency for Anxiety and Apprehension to increase in the fifth hour, before the syndrome again declines toward the end of the day.

Irritation and Hostility are also normal outlets, and we would expect them to follow the pattern of the previous

† Morimoto, K.: Subjective Graphic Study of LSD Symptom Intensity, 1953 Annual Report to Geschickter Foundation.

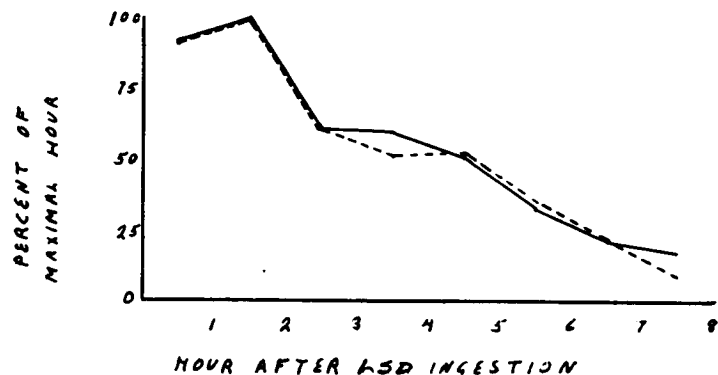
two groups. A satisfactory explanation of the divergence of this symptom group from the form of the rest of the "normal" processes (Gregariousness and Anxiety) entailed a minute search of protocols. The subject, confronted with a psychotic experience and in the midst of experimenters and authority figures, would not be expected to show hostility.¹¹ For the most part this is the case, since as a group of symptoms the count at its maximal hour is smaller than that of any group, with the exception of Inappropriate Laughter and Smiling. Further, probing into the protocols reveals

and hour, drop sharply in the third hour, and wane gradually from the fourth hour onward.

Neuromuscular and Cutaneovascular symptoms are most often considered the physical correlates of anxiety and/or tension, and may also be regarded as the beginning phases of depersonalization.¹² In these results, they are the first symptoms which the subject reports as drug-induced changes and appear along with the Gregariousness and Anxiety.

The symptom group termed Awayness (Fig. 4) has a remarkable growth in the second hour. The nonrelation or lack

Fig. 3.—Neuromuscular symptoms (solid line) and cutaneovascular symptoms (broken line).



that in our experimental situation hostility has an inverse relationship to anxiety; i.e., anxious subjects were least likely to be hostile. Situationally, our subjects are encouraged to relate by reporting experiences and symptoms to the experimenters. In refractory subjects this pressure to relate is countered by hostility and suppression of psychotic phenomena.

Neuromuscular symptoms (Fig. 3) are observed in great quantity during the first hour of LSD psychosis. They attain a maximal peak in the second hour, followed by a sharp decline in the third hour and gradual decline thereafter. Symptoms of the Cutaneovascular variety adhere to a very similar pattern. They have a large relative frequency in the first hour, reach a peak in the sec-

ond hour, drop sharply in the third hour, and wane gradually from the fourth hour onward. of interpersonal processes signified by the appellation is seen only sporadically in the first hour, when the physical symptoms have been found to be already present in quantity. In the second hour, this type of behavior is trebled and shows a slight increase in the third hour, at which time somatic complaints are considerably reduced. Of note here is the trough in the fifth hour, which will interest us later. Awayness has both adaptive and maladaptive components, for it may be used as a strategic withdrawal from interaction in order to arrive at a satisfactory solution of complex interpersonal processes, or it may reflect a passive, inferior adaptation of one's resources, which, in its extreme, is viewed as a psychological death. In this context, the relation of Thought Confusion to Away-

PROGRESSION OF LSD EFFECTS

ness (Fig. 4) is regarded as significant; failure of intrapsychic mastery or conflict about utilization of this withdrawal defense results in Thought Confusion in some subjects. It would seem implied that attempts at symbolic mastery (Awayness) of a stressful situation results in the subjectively crippling symptoms of Thought Confusion.

The frequency of Inappropriate Laughter and Smiling (Fig. 6) is small, but its relationship to Anxiety and Hostility shall be discussed, for the dichotomy of anxious and hostile subjects yields a correlation indicative of personality types. In our group of anxious subjects, Inappropriate Laughter and Smiling has an inverse relationship to Hostility. As

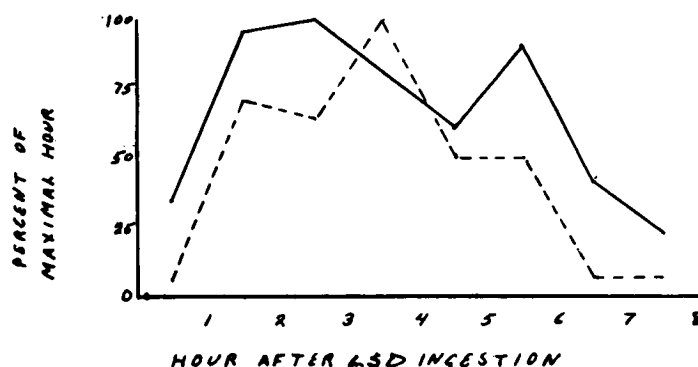


Fig. 4.—Awayness (solid line) and thought confusion (broken line).

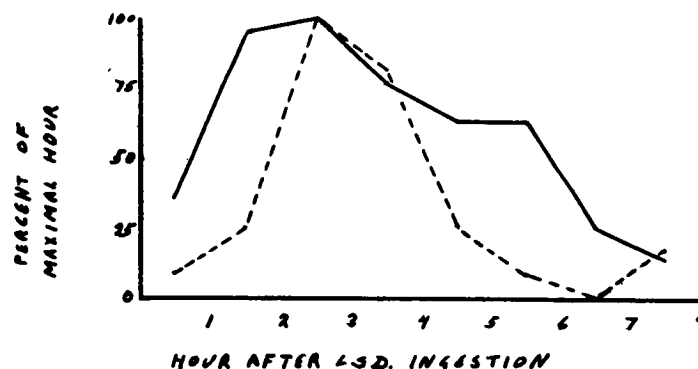
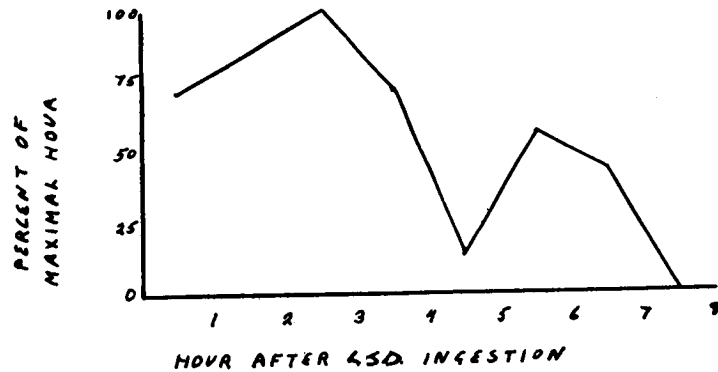


Fig. 5.—Perceptual distortion (solid line) and unreality (broken line).

Perceptual Distortion, like Awayness, has a sharp increase in the second hour and is maintained high up to and including the sixth hour. Pervasive feelings of unreality are almost absent in the second hour, but rapidly increase to a maximum in the third hour, remain high in the fourth hour, but wane fast in the fifth hour. Unreality seems to lag Perceptual Distortion in the same manner that Thought Confusion follows Awayness.

laughter increased, in the fourth hour, hostility decreased; as hostility increased, in the fifth hour, laughter dropped out entirely, and as laughter increased, in the sixth hour, hostility again decreased. In the hostile subjects the relationship is positive. In this group both Hostility and Inappropriate Laughter and Smiling reached a peak in the third hour and a trough in the fourth and fifth hours. The anxious subject is aware of his need of reassurance from the observer

Fig. 6.—Inappropriate laughter and smiling.



and cannot, therefore, be rejecting of him.

In Figure 7 related symptom groups are shown together. The major discrepancy of form occurs in the non-normal, nonsomatic symptoms at the fifth hour. Examination of the decrease and increase of these symptom groups reveals that the decrease of Unreality in the fifth hour is accompanied by a decrease in Awayness, Thought Confusion, and Inappropriate Laughter and Smiling. The increased or same normal processes, at this same hour, would lead us to believe that the psychotic experience was over and that integration of said experiences was being made. However, the somatic processes and perceptual distortion in the hour are unchanged, indicating that the subject is still giving reality to unreal experiences (Perceptual Distortion) or somatizing affect (physical

symptoms). The subject's apparent integration of the lysergic experience is premature.

The relapse in the sixth hour substantiates the thesis of premature integration. The subject, again aware of strange and alien sensations, becomes preoccupied. Other people's actions being incongruous with his internal orientation, he responds with inappropriate laughter and smiling. Conversely, the subject's attempt to behave normally in the fourth and fifth hours is reflected by a decrease of inappropriate outbursts.

Consolidation and Comment

The presentation was influenced by two overlapping factors: the hour that the symptom group was maximal and the type of symptom groups. Gregariousness, Anxiety and Apprehension, Irrita-

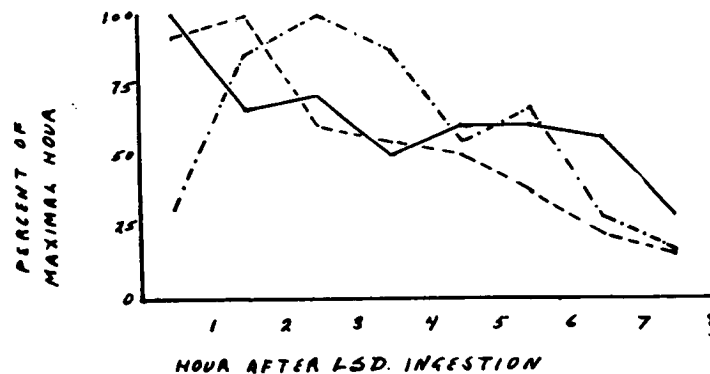


Fig. 7.—Normal: gregariousness, anxiety, hostility (solid line). Somatic: neuromuscular and cutaneousvascular (broken line). Abnormal nonsomatic: awayness, thought confusion, inappropriate laughter and smiling, perceptual distortion, unreality (line of dots and dashes).

PROGRESSION OF LSD EFFECTS

TABLE 1.—Percentages for the Seven Figures

Hour	1	2	3	4	5	6	7	8
Figure 1								
Gregariousness	100	78	67	61	50	67	72	33
Anxiety and apprehension	100	36	45	36	55	45	27	18
Figure 2								
Hostility	78	67	100	33	78	56	44	22
Figure 3								
Neuromuscular symptoms	92	100	61	59	51	33	22	18
Cutaneousvascular symptoms	91	100	61	52	52	35	22	9
Figure 4								
Thought confusion	7	71	64	100	50	50	7	7
Awayness	35	96	100	81	62	91	42	23
Figure 5								
Perceptual distortion	36	95	100	77	64	64	27	14
Unreality	9	27	100	82	27	9	0	18
Figure 6								
Inappropriate laughter and smiling	71	86	100	71	14	57	43	0
Figure 7								
Normal	100	67	72	50	61	61	56	28
Somatic	92	100	61	55	50	37	22	15
Abnormal Nonsomatic	32	87	100	88	55	67	28	16

tion and Hostility (Figs. 1 and 2) form a syndrome which is familiar to our everyday experience; they can be found in a normal sampling of people going through their routine activities. The first two mentioned manifestations of normal behavior are at a peak immediately after the ingestion of the drug, while Irritation and Hostility is seen infrequently, and only in a minority of subjects. The subject placed in a novel social situation of experimental design and faced with the prospect of a psychotic experience can be said to be appropriately friendly, appropriately anxious, and minimally hostile. This is a pattern of behavior most conducive to securing nurturance and affiliation and warding off unpleasant action. As the drug becomes effective, other patterns become operative.

The second set of symptom groups which cluster together under a wider category are the Neuromuscular and Cutaneousvascular symptoms, as shown in Figure 3. These physical signs are the first indication which the observer has that an abnormal process may be taking place in the subject. Somatic phenomena

occur with great frequency in the first hour and are most marked in the second hour. Gregariousness, and Anxiety and Apprehension are declining in the second hour, while Neuromuscular and Cutaneousvascular symptoms are increasing. It could be said that the latter represent anxiety equivalents and, broader, affect equivalents.¹² Physical signs and symptoms, often regarded as neurotic, may also be the normal response of the subject to a stressful situation.¹³ As other types of symptoms appear in the third hour, somatic signs are less numerous but are maintained until the fifth hour.

The third set of symptoms is considered ideational, or internalized (Fig. 4). The subjective rumination and withdrawal of the Awayness symptoms may result in confusion, manifested by paranoid ideas or exaggerated emotional outlet, such as crying. The extended peaks of the Awayness and Thought Confusion groups overlap, and in some subjects these symptoms overshadow the peaks of somatic dysfunction, Perceptual Distortion, and Unreality. Any and all of the latter may serve to precipitate Away-

ness and Thought Confusion, which, in turn, may serve to conceal what both subject and observer regard as psychotic phenomena (Distortions and Unreality).

The fourth set of symptoms consists of Perceptual Distortion and feelings of Unreality (Fig. 5). Having in common a perceptual element, these two differ in that the former is customarily unaccompanied by affect, perhaps being an ego defense against the recognition of inadmissible impulses and emotions, while the latter goes by the feelings of unreality. Perceptual Distortions and Unreality are both at a peak in the

TABLE 2.—*Peaks of Symptom Groups*

Symptom Class	Hour of Peak
Normal Gregariousness Anxiety Hostility	1
Somatic Neuromuscular Cutaneousvascular	2
Abnormal Nonsomatic Awakeness Thought Confusion Perceptual Distortion Unreality Inappropriate Laughter and Smiling	3

third hour, but Unreality stays high in the fourth hour, thus indicating possibly that after a final attempt to ward off objectionable feelings by somatizing, mentalizing, and misperceiving the reality of situations, the objectionable impulses and affects are again felt clouded in the aura of unreality.

In summary, the peak of the symptom group is later in time as we proceed from normal behavior to somatic dysfunction to mental and perceptual aberration (Table 2 and Fig. 7). Normal behavior overlaps and appears to be supplanted by physical complaints, which, in turn, give way to ideational preoccupation, distortions of reality, and unreality feelings. The impression is that a cycle is completed by the return of affect.

Conclusion

In our introduction we listed points of view. Some workers emphasized the therapeutic possibilities of LSD; others focused attention on hallucinatory, delusional, and depersonalization material. Our own results, undoubtedly influenced by the schema selected to condense the raw data, resulted in a differential progression of variously rationalized groups. We then interpreted the progression of groups as the substitution of diverse mechanisms as a method of warding off objectionable feelings and impulses. Whether the progression of such mechanisms can be manipulated toward therapeutic ends cannot be resolved from these observations. Additionally, personality factors and situational determinants must be considered.

Hyde¹⁰ has shown that exacerbation or alleviation of symptoms in the lysergic psychosis is partially dependent on the situation of which the subject is a part and that the subject's perceptions (hallucinations and delusions) are conditioned by the attitudes and feelings of those people with whom he interacts.

Bockoven's point of view,[§] that as the lysergic symptoms are analyzed in the context of social psychology they seem to take meaning as adaptive to the situation, is pertinent. As the observer removes himself from his fixed point of reference and analyzes the total situation for its import on the lysergized subject, he understands that what on the surface may appear as hallucination and delusion may actually turn out to be a penetrating insight or perception the meaning of which may not be apparent to either subject or observer.

We conclude that the progression of mechanisms seen with LSD may be used either as a means of observing and dis-

§ Bockoven, J. S.: Effects of Social Situations on the Quality of Interpersonal Relations and Symptom Intensity in Lysergic Acid Psychosis, 1953 Annual Report to Geschickter Foundation.

playing curious "pathological" phenomena or as a therapeutic aid in making defense mechanisms available for scrutiny to subject and therapist. The purpose served will depend upon the skill, inclination, understanding, and intention of both subject and observer.

Summary

After summarizing some of the lysergic literature and the need for documentation of the LSD syndrome demonstrated, we defined 10 symptom groups in terms of the bipolar relationship of subject and environment.

A step-like progression is noted in our results:

1. Normal processes of Gregariousness and Anxiety and Apprehension are most marked in the first hour, when the drug action is not fully effective.

2. Somatic symptoms appear in the first hour, reaching a peak in the second hour.

3. Perceptual Distortion, present in the first hour, increases in the second hour and is at a peak in the third hour.

4. Unreality is at a peak in the third hour and is well maintained in the fourth hour.

5. Awayness or ideational phenomena accompany the preceding processes from the second to the sixth hour.

6. Thought Confusion, with its peak at the fourth hour, is interpreted as the break through when attempts at intrapsychic mastery of stressful situations, as indicated by the Awayness phenomena, fail.

7. The trough, in the fifth hour, of Awayness is seen as a premature attempt to integrate the experience and behave normally.

[The hypothesis is offered that objectionable impulses and feelings are warded off progressively by diverse mechanisms. Somatization of affect may be succeeded by misperception of reality and feelings of unreality, while preoccu-

pation in the mental sphere may accompany any of these processes. A cycle seems to be completed with the return of feelings of unreality.]

8. After the sixth hour, all symptom groups, with minor exceptions, show a general decline.

Therapeutic potentialities of LSD are mentioned.

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