Psychological Reports, 1966, 19, 211-227. © Southern Universities Press 1966
Monograph Supplement 2-V19

PSYCHEDELIC AGENTS IN CREATIVE PROBLEM-SOLVING: A PILOT STUDY[1,2]

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Summary.—Based on the frequently reported similarities between creative and psychedelic (drug-induced, consciousness-expansion) experiences, a preliminary study was conducted to explore the effects of psychedelic agents (LSD-25, mescaline) on creative problem-solving ability. Twenty-seven professionally employed males were given a single psychedelic experience in 1 of 7 small groups (*ns* = 3 or 4) following extensive selection and preparatory procedures. This drug-induced problem-solving session was carefully structured with particular focus on establishing *Ss*' expectancies and a psychosocial milieu conducive to creative activity. Tentative findings based on tests of creativity, on subjective reports and self ratings, and on the utility of problem solutions suggested that, if given according to this carefully structured regimen, psychedelic agents seem to facilitate creative problem-solving, particularly in the "illumination phase." The results also suggest that various degrees of increased creative ability may continue for at least some weeks subsequent to a psychedelic problem-solving session.

In recent years, psychedelic agents such as LSD-25, mescaline, and psilocybin, have been used in the treatment of a variety of emotional disorders (Hoffer, 1965; Mogar & Savage, 1964). Researchers have noted similarities between the drug-induced state and certain phases of the creative process (Barron, 1963; Mogar, 1965). Wallis (1926) has defined the stages of creation as (1) preparation, (2) incubation, (3) illumination, and (4) verification. With reference to the illumination phase of creativity, Barron (1963) reported that creative people "deliberately induce in themselves an altered state of consciousness in which the ordinary structures of experience are broken down. The ordinary world may thus be transcended." Further, Barron recommended the application of psychedelic drugs to the study of creativity: "Certain

[1]The project reported here is part of an ongoing research program supported by grants from the John Lindsley Fund and the Ittleson Family Foundation, both of New York City, Professor Robert E. Mogar, Principal Investigator.
[2]The authors are indebted to James Watt, M.D., Psychiatrist, Medical Director of the International Foundation for Advanced Study, 1149 Chestnut Street, Menlo Park, California, for his assistance throughout the conduct of this study. He administered all drugs used in the medical facility of the International Foundation for Advanced Study which was approved for research with psychedelic agents by the Food and Drug Administration (Permit IND-2504; James Watt, M.D., Investigator). Principle 16 of the Ethical Standards of Psychologists [*Amer. Psychologist*, 1965 (December), 1034] was strictly adhered to. Signed releases were required for all *Ss*.
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aspects of the creative process, although by no means the creative process as a whole, are analogous to the kind of breaking up of perceptual constancies that is initiated mechanically by the ingestion of the drug."

A more comprehensive rationale for the use of psychedelic agents as facilitative of creative activity is suggested by Rogers' conditions for fostering creativity (1959, condensed from the original):

> The *inner conditions* are three: (a) low degree of psychological defensiveness; lack of rigidity and permeability of boundaries in concepts, beliefs, perceptions, and hypotheses; tolerance for ambiguity where it exists, ability to receive and integrate apparently conflicting information; sensitive awareness of feelings and openness to all phases of experience; (b) evaluative judgment based primarily, not on outside standards or prejudices, but on one's own feelings, intuition, aesthetic sensibility, sense of satisfaction in self-expression, etc.; (c) the ability to "toy" with ideas, colors, shapes, hypotheses; to translate from one form to another; to think in terms of analogues and metaphors.
>
> *External conditions* are two: (a) an atmosphere of psychological safety, in which the individual feels accepted as of unconditional worth; in which he feels he can be spontaneous without fear that his actions or creations will be prematurely evaluated by rigid external standards; in which he feels empathic understanding; (b) an atmosphere of psychological freedom; of permissiveness to think, to feel, to be whatever is discovered within oneself.

Within this framework, the psychedelic state would be expected to enhance creativity *temporarily* insofar as the "external conditions" were present in the session milieu and to the extent that the "inner conditions" were induced or facilitated by the experience. In addition, *long-term* changes would be expected to occur if the "inner conditions" were permanently altered by the experience and/or if *S* became less affected by non-ideal "external conditions."

As noted earlier, a number of specific attributes and abilities related to creativity are often observed to be heightened *during* the psychedelic experience. This is the case if the session is so oriented and when *S* is prepared to expect such intensification. In studies of the therapeutic efficacy of psychedelic drugs, the *long-term* changes bear a striking similarity to behavior under creativity-fostering conditions. In a study of nearly 400 patients, Savage, *et al.* (1966) reported the following changes in values and personality based on extensive test data, observer ratings, follow-up interviews, and subjective reports: greater spontaneity of emotional expression, more adequate ego resources, reduction in depression and anxiety, less distance in interpersonal relations, more openness to experience, increased aesthetic appreciation, deeper sense of meaning and purpose in life, and an enhanced sense of unity with nature and humanity. Such results suggest that, used in an appropriate context, psychedelic agents may facilitate lasting change in the direction of increased creative expression and self-actualization.

With regard to the apparent creativity-fostering potential of psychedelic agents, it is essential to recognize the crucial importance of the expectations of

all persons involved in the session, and of the psychosocial milieu in which the session is conducted. If expectations and intentions are primarily therapeutic, *S* is likely to find that his personal problems occupy the center of his experience. If an ingestant expects "kicks," then euphoria and visions may be the result. But, if *S* is prepared to expect that distractions will be at a minimum and that he will be able to focus his attention and resources on creative problem-solving, then the likelihood of enhancement of performance will be greatly increased. The confidence of *E*, based on personal experience, that the process "works," is an essential ingredient. The psychedelic *S* is extremely sensitive in his heightened state of empathic awareness to doubt conveyed by *E*.

These important aspects of the drug-induced state help reconcile otherwise contradictory findings. Studies indicate that many kinds of performance tend to deteriorate or remain unchanged during the acute phase of the experience (cf., Trouton & Eysenck, 1961). Other investigators report enhancement of various kinds of performance during and subsequent to the psychedelic state (Hoffer, 1965). The preliminary findings of the present exploratory study suggest that, when performance impairment occurs, it may be attributed at least partially to an anxiety-provoking setting and/or the negative expectations of *S* and *E*.

Other specific characteristics of the psychedelic experience are listed in Table 1. The left-hand column includes frequently reported attributes which would tend to facilitate creative activity. The right-hand column contains features which might operate to hinder creativity or make communication difficult, especially in a group-conducted problem-solving situation.

When the problem is viewed in terms of complex transactions between pharmacologic and psychosocial variables, it becomes apparent that the enhancement of creativity by means of psychedelic substances requires that the facilitating characteristics be carefully cultivated and the hindering characteristics minimized or eliminated. The key to this task is the establishment and maintenance of an appropriate set in *S*, both prior to and during the psychedelic problem-solving session.

The exploratory study reported here is an initial attempt to obtain data relevant to three empirical questions: (1) Does the psychedelic experience enhance creativity and if so, what is the evidence of enhancement? (2) Does the experience result in the production of concrete, valid, and feasible solutions, as viewed by the pragmatic criteria of industry and science? (3) Does the psychedelic experience result in demonstrable long-term personality changes in the direction of increased creativity and self-actualization?

One further point requires elucidation. For reasons explained immediately below, the design of this and further research involves comparison of an *S*'s performance during a problem-solving session with the same *S*'s performance at other times and with other *S*s' performance under "normal" or no-drug con-

TABLE 1

SOME REPORTED CHARACTERISTICS OF THE PSYCHEDELIC EXPERIENCE

Those supporting creativity	Those hindering creativity
1. Increased access to unconscious data.	1. Capacity for logical thought processes may be diminished.
2. More fluent free association; increased ability to play spontaneously with hypotheses, metaphors, paradox, transformations, relationships, etc.	2. Ability to consciously direct concentration may be reduced.
3. Heightened ability for visual imagery and fantasy.	3. Inability to control imaginary and conceptual sequences.
4. Relaxation and openness.	4. Anxiety and agitation.
5. Sensory inputs more acutely perceived.	5. Outputs (verbal and visual communication abilities) may be constricted.
6. Heightened empathy with external processes, objects, and people.	6. Tendency to focus upon "inner problems" of a personal nature.
7. Aesthetic sensibility heightened.	7. Experienced beauty may lessen tension to obtain aesthetic experience in the act of creation.
8. Enhanced "sense of truth," ability to "see through" false solutions and phony data.	8. Tendency to become absorbed in hallucinations and illusions.
9. Lessened inhibition, reduced tendency to censor own by premature negative judgment.	9. Finding the best solution may seem unimportant.
10. Motivation may be heightened by suggestion and providing the right set.	10. "This-worldly" tasks may seem trivial, and hence motivation may be decreased.

ditions. It does not include comparison with the same *S*'s performance when expectancy is eliminated or when the psychedelic drug is eliminated, other factors being presumably the same.

The aim of this research was to devise a way of using drugs to optimize conditions for creative problem-solving by humans. It is not conceived as an attempt to establish experimentally the psychological effects of a psychedelic drug. In fact previous research with the psychedelic agents has shown (Mogar, 1965) that this latter is an extremely difficult if not a rather futile question. There are no specific psychological reactions to these drugs; there are, rather, various reactions depending upon such variables as expectancies of *S* and *E*, *S*'s degree of trust, the over-all setting, *S*'s personality characteristics, etc. The psychedelic agent in this case is part of the complex, including the expectancy and motivation of *S*, which is being investigated. Reduction or elimination of any one of these three main ingredients of expectancy, motivation, or psychedelic agent clearly alters the efficacy of the procedure. The question under scrutiny is to what extent performance can be enhanced when all factors are optimized.

The question of the relative contribution of the various elements of this procedure is valid. It is not under study here, partly because the matter of separating out one of the factors is much more difficult than may appear superficially to be the case. To eliminate the psychedelic agent, for example, without at the same time affecting the expectancy variable is very difficult, if not impossible. Neither the experienced investigator nor the naive *S* is easily fooled on the matter of whether he has received a psychedelic substance or merely a psychoactive placebo such as amphetamine. Thus, even if the research design ostensibly uses a double-blind technique, expectancies of *E* and of *S* vary according to their appraisals (fairly accurate) as to whether or not *S* has received a psychedelic drug.

METHOD

Selection of Subjects

The participants were 27 males engaged in various professional occupations, i.e., engineers, physicists, mathematicians, architects, a furniture designer, and a commercial artist. Most *S*s had no previous experience with psychedelic agents.[6] They were selected from local industries and academic institutions according to the following criteria: (1) Participant's occupation normally requires creative problem-solving ability. (2) Participant is psychologically normal with stable life circumstances as determined by psychiatric interview-examination. (3) Participant is adequately motivated to discover, verify, and apply problem-solutions within his industrial or academic work capacity.

[6]Eight *S*s (Nos. 103, 104, 204, 207, 211, 212, 214, 220) had two or more previous LSD sessions with dosages of 200 mcg. or more. One of these (No. 212) participated in earlier trial sessions. The remaining 19 had no previous psychedelic experience.

Procedure Prior to Sessions

As indicated previously, considerable attention must be paid to establishing the appropriate expectancy, or more generally, to the careful preparation of each *S* prior to his participation in an experimental session.

Ss were instructed to select one or more problems of professional interest which required a creative solution. A number of participants had worked weeks or months on their chosen problems without obtaining a satisfactory solution. In addition to the psychiatric examination (with the psychiatrist who would supervise the psychedelic session) at least one pre-session interview was conducted with each *S* plus a minimum of one meeting attended by those *Ss* who would participate simultaneously, i.e., as a group. The focus of these preliminary meetings was twofold: first, to allay apprehension and establish rapport and trust among all persons involved; and second, to structure in considerable detail the conduct of the session. Instructions emphasized that the experience could be directed as desired. *Ss* were told that they would not experience difficulty with such distractions as visions, involvement with personal problems, and so on. Instead, they would find that, following an initial period of 2 or 3 hr. for "getting into" the psychedelic state, they would be able to concentrate on the assigned tasks with ease and would be able to work more effectively than usual. The agenda and sequence of events to be followed in the study were outlined in detail. Thus, before engaging in the problem-solving session, participants were generally positively and enthusiastically expectant, with a clear picture of what would take place and under what conditions, and had information on how to cope with various exigencies that might arise.

Procedure During Sessions

The first step in testing the hypothesis that psychedelics could be used to enhance creativity was to conduct trial group sessions to work out techniques and gain experience. A group-size of four was decided upon as being both economical and manageable. (If at the last minute an *S* dropped out, *n* was 3.) In each group were also two observers who did not take any drugs. Initially it had been anticipated that the group would be difficult to manage if the dosage was too high. Preliminary informal trials with varying dosages indicated that up to 200 mg. of mescaline sulfate (or the approximate equivalent, 100 mcg. of LSD) could be used without difficulty.

For the 7 sessions reported here (involving basically 27 *Ss*) the drug regime included as primary active agent 200 mg. of mescaline.[7] During the session an initial period of about 3 hr. was spent quietly listening to music with stereo earphones. *Ss* were advised to "turn off" their analytic faculties, to re-

[7]Research psychologists interested in a more exact description of procedures used should contact the author directly. Mescaline sulfate was procured from F. Hoffmann LaRoche Co., Basel, Switzerland.

lax and accept whatever form of experience came their way, to refrain from attempting to control the sequence or nature of the events. The declared aim was to stop using one's cognitive and perceptual processes in the familiar way and to heighten the likelihood of discovering new ways.

After this initial "quiet period" *S*s were roused and encouraged to talk with one another briefly. Snacks were available. Approximately an hour was then devoted to psychological testing. (Alternate forms of the tests had been administered during the pre-session meeting.)

Following the testing, *S* spent 3 to 4 hr. solving the problem he had previously chosen. During this main problem-solving period, the participants worked by themselves, usually in total silence. Toward the end of the afternoon *S*s often shared experiences and sometimes worked together on a problem brought in by one of the participants. *S*s were driven home about 6 PM, with a sedative which they could take if difficulty in sleeping occurred. In many cases they preferred to stay up as late as 4 AM, working out insights discovered earlier in the day.

Assessment Procedures

In addition to the psychological test data obtained before and during the session, each participant was asked to submit a subjective report of his experience within several days after his experimental session. Each was also asked to answer a questionnaire concerning various aspects of the experience. Three to 6 wk. after the session, *S* was interviewed by the psychiatrist and asked to respond to a questionnaire related to (1) the effect of the psychedelic experience upon post-session creative ability and (2) the validity and acceptance of solutions conceived during the session, according to the pragmatic criteria of industry and science.

From the data of this exploratory study, the effects of a psychedelic agent on creative performance were evaluated in three ways: (1) an analysis of change scores on tests of creative ability administered several days prior to and again during the acute phase of the experimental session; (2) a content analysis of subjective reports for evidence of generally recognized components of the creative process and distinguishing features of creative solutions; and (3) subjection of the solutions derived in the session (theories, inventions, designs, etc.) to the pragmatic test of scientific, industrial, and/or commercial endorsement.

RESULTS AND DISCUSSION

Psychometric Data[8]

Three objective tests of creativity were administered several days prior to

[8]A transcript of raw data has been filed with the American Documentation Institute, Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington, D. C. 20540 as Document No. 8953. Remit $1.25 for photocopies or 35-mm. microfilm.

and again during the acute drug phase of the problem-solving sessions. (For two of the tests data were not obtained from all *Ss.*) All three tests have reported split-half reliabilities of over 0.90. In the pre-drug session and in the drug session, the order of taking the two forms was reversed for half the *Ss.* Test-retest reliability data are not available; however, published research with these tests indicates that practice effects are not significant.

Purdue Creativity Test.—*S*'s ($n = 18$) task is to find as many uses as possible for each of a variety of pictured objects (Lawshe & Harris, 1960). The test is scored for two subscales, fluency of ideas under time pressure and flexibility or range of solutions. Net positive change on the fluency scale was significant (13 of 18 males; $\chi^2 = 5.88$, $df = 12$, $p < 0.02$). Change on the flexibility score was not statistically significant (10 of 18 males increased their scores). Mean change of combined score from pre-session testing to the testing during the session was +15 percentile points (matched against engineering-student norms). Individual shifts ranged from −30 to +60 percentile points for 14 of the *Ss.* Further inference cannot be drawn in the absence of more complete validation data.

Miller Object Visualization Test.—*S*'s ($n = 27$, 8 females[9] and 19 males) task is to envision a two-dimensional outline figure folded into a solid (Miller, 1955). Approximately half the *Ss* reported that the alternate form taken during the psychedelic session seemed easier and averaged about half the time taken for the earlier testing. About a third of the *Ss* reported using a more visual approach, and each of these improved his score on the second testing (or took less time to achieve the same score). One *S* reported experiencing greater difficulty on the second test and indicated that he had attempted purely analytical solutions. Improvement in performance was significant ($\chi^2 = 6.00$, $df = 26$, $p < 0.02$). A ceiling effect limited the change scores for this instrument.

Witkin Embedded Figures Test.—*S*'s ($n = 14$, 4 females[9] and 10 males) task is to distinguish a simple geometrical figure embedded in a complex colored figure (Witkin, 1950). Every *S* but one male improved on this measure. Mean time for locating the 12 figures was 404 sec. for the pre-session testing and 234 sec. for the testing during the session. Performance enhancement was significant ($\chi^2 = 8.64$, $df = 13$, $p < 0.01$). These are extremely high and significant changes (individual improvements in speed up to 200%) compared with changes observed in previous research with this instrument (Witkin, *et al.*, 1962).

The implications of these data are twofold. First, it is clear that scores on a stable test can shift dramatically upward under the drug condition and sec-

[9]Scores of female *Ss* were obtained in sessions structured exactly like those of the male *Ss* except that the nature of their problems was somewhat different. These few scores are included here since test results are at best rather skimpy.

ond, this shift is in the direction of enhanced ability to recognize patterns, to isolate and minimize visual distraction, and to maintain visual memory in spite of confusing color and spatial forms. Viewed as personality change, these *S*s showed a shift from "field dependence" to "field independence," as defined by Witkin, *et al.* (1962). Research has related this dimension to numerous performance variables, including autonomic stability, concept formation, resistance to suggestion in reporting illusions, and resourcefulness in ambiguous situations (e.g., Elkind, *et al.*, 1963; Elliott, 1961). As measured by the embedded figures test, field-dependence-independence has been reported to be resistant to a variety of experimental interventions including stress, training, sensory isolation, hypnosis, and the influence of a variety of drugs (Witkin, *et al.*, 1962).

Subjective Ratings

Following the experimental session, each *S* completed a brief questionnaire in which he rated his experience with respect to nine characteristics relevant to creative problem-solving. Each characteristic was rated along a 5-point scale from −2 (marked impairment) through 0 (no change) to +2 (marked enhancement). The nine characteristics with average ratings are listed below:

1. Lowering of defenses, reduction of inhibitions and anxiety	+1.7
2. Ability to see the problem in the broadest terms	+1.4
3. Enhanced fluency of ideation	+1.6
4. Heightened capacity for visual imagery and fantasy	+1.0
5. Increased ability to concentrate	+1.2
6. Empathy with external processes and objects heightened	+0.8
7. Empathy with other people heightened	+1.4
8. Data from "unconscious" more accessible	+0.8
9. Enhanced sense of "knowing" when the right solution appears	+1.0

These results may be summarized by noting that selected visual and verbal skills were enhanced for some and that this enhancement was objectively measurable. It cannot be concluded that all mental functioning will be subject to the same enhancement; however, it appears that performance levels on specific creative abilities can be temporarily improved if the psychedelic session is specifically focused appropriately.

The increased intuitive skills reflected in these test results are consistent with the cardinal features of psychedelic therapy, including reduced defensiveness, reliving early memories, increased awareness of unconscious material, and greater emotional expression. These results strengthen the proposition that it is important to define set and setting accurately in interpreting the results of research with psychedelic agents.

Subjective Reports

The literature on creativity includes analytical description of the components of creative experience, the personal characteristics of creative individuals, and the distinguishing features of creative solutions. From the participants' reports it was possible to extract 11 strategies for creative problem-solving, or experiential modes related to creativity, which were reported as heightened during the session. These 11 aspects of the creative process, their correspondence with current theory and research on creativity, and representative quotations from subjective reports are detailed below.

(1) *Low inhibition and anxiety.*—Examples of comments are:

> There was no fear, no worry, no sense of reputation and competition, no envy, none of these things which in varying degrees have always been present in my work.
>
> A lowered sense of personal danger; I don't feel threatened anymore, and there is no feeling of my reputation being at stake.
>
> Diminished fear of making mistakes or being embarrassed.

Each of the four major theoretical orientations—psychoanalytic, behavioristic, Gestalt, and existential—emphasizes the necessity of this condition of creativity. Also, a mass of empirical evidence indicates that inhibition and anxiety narrow perception, reduce the breadth of conscious-unconscious awareness, and impair cognitive and psychomotor performance. Bruner's (1962) criterion, "Freedom to be dominated by the object," means specifically, "free of the defenses that keep us hidden from ourselves." Maslow's "self-actualizing person" and Rogers' "fully-functioning person" stress the importance of being unfrightened by the unknown, the mysterious, the puzzling (Mackler & Shontz, 1965). Getzels and Jackson (1962) found that the homes of creative persons are relatively threat-free and uninhibited. It seems apparent that circumstances that reduce anxiety will facilitate creative experience.

(2) *Capacity to structure problems in a larger context.*—Sample comments from *Ss* are:

> Looking at the same problem with (psychedelic) materials, I was able to consider it in a much more basic way, because I could form and keep in mind a much broader picture.
>
> Ability to start from the broadest general basis in the beginning . . .
>
> I returned to the original problem . . . . I tried, I think consciously, to think of the problem in its totality, rather than through the devices I had used before.

The Gestalt position views creativity in terms of reorganization or restructuring of the *total* stimulus field. Wertheimer (1945) notes that each step in the creative process is taken by surveying the whole situation, the total dynamic field. The importance of seeing a problem from a larger perspective is given explicit expression in G. Murphy's principle of *progressive mastery* (1963). A behavioristic concept of creativity formulated by Mednick (1962)

emphasizes the associative hierarchy of elements; the ability to bring remote ideas into contiguity to form creative matrices. The larger context also finds expression in Koestler's (1964) concept of "bisociation" and in Guilford's (1959) primary trait, *divergent thinking*, which denotes viewing the molecular from the vantage point of the molar.

(3) *High fluency and flexibility of ideation.*—Illustrative comments by *S*s are:

> I began to draw . . . . my senses could not keep up with my images . . . . my hand was not fast enough . . . . I was impatient to record the picture (it has not faded one particle). I worked at a pace I would not have thought I was capable of.
>
> My mind seemed much freer to roam around the problems, and it was these periods of roaming around which produced solutions.
>
> . . . I dismissed the original idea entirely, and started to approach the graphic problem in a radically different way. That was when things began to happen. All kinds of different possibilities came to mind.

Based on extensive research and quantification of creative abilities, Guilford (1959) considers fluency and flexibility the two crucial attributes. His primary factors include (1) word fluency, associational fluency, and ideational fluency; and (2) flexibility of thinking, composed of spontaneous flexibility and figural adaptive flexibility. These same attributes are included in the psychoanalytic condition of creativity, "deautomatization" (Hartmann, 1958) or the relaxing of ego boundaries.

(4) *High capacity for visual imagery and fantasy.*—Three examples of *S*s' comments are:

> I tried to relax and create a completely white and clear mental image. Suddenly I was not in the present but experienced very vivid technicolor, dreamlike mental pictures.
>
> I began to see an image of the circuit. The gates themselves were little silver cones linked together by lines. I watched this circuit flipping through its paces . . . The psychedelic state is, for me at least, an immensely powerful one for obtaining insight and understanding through visual symbolism.
>
> I began visualizing all the properties known to me that a photon possesses . . . . The photon was comprised of an electron and a positron cloud moving together in an intermeshed synchronized helical orbit . . . . This model was reduced for visualization purposes to a black and white ball propagating in a screw-like fashion through space. I kept putting the model through all sorts of known tests . . .

This cardinal feature of the psychedelic experience has been associated with creativity since man's earliest history. It is not surprising then that this attribute occupies a central position in current theories of creativity supported by a large body of empirical evidence (Holt, 1964). The psychoanalytic view formalizes the importance of retaining the child's capacity for fresh, free-flowing perception and thought. Among the conditions conducive to creativity, Kris (1952) lists capacity for regressive experiences, richness of imagination, and

ability to convert fantasy into creative products. These conditions are embodied in the term, "regression in the service of the ego"—the hallmark of creative inspiration. The notion of creative regression has been further elaborated by Schachtel (1959) with particular emphasis on the key role of visual imagery as a mode of thought. The same attributes are embraced in Rorschach's concept of *inner creation*, Bleuler's account of constructive *autistic thinking*, Werner's *physiognomic perception*, and Adler's *creative self* (Stark, 1964).

(5) *High ability to concentrate.*—Examples from *Ss*' comments follow:

I was impressed with the intensity of concentration, the forcefulness and exuberance with which I could proceed toward the problem.

The drug appeared to maintain motivation to pursue what is aesthetically intriguing to a point far beyond what I would do normally.

I was amazed at the four hours that had passed and would have guessed that it was only one and one-half hours.

In what seemed like 10 minutes, I had completed the problem, having what I considered (and what I still consider) a classic solution.

The importance of sustained focus of attention, separating the essential from the nonessential and eliminating irrelevant elements, has been particularly emphasized in behavioristic formulations. Considerable laboratory research indicates a direct positive relationship between ability to concentrate and enhanced performance in problem solving (Mednick, 1962). Roe (1953) found that prolonged concentration was a prominent characteristic in the lives of creative thinkers. From a more dynamic standpoint, the existential position also emphasizes concentration. The word "absorption," "involvement," "being caught up in," seem to catch the intense enrapturement of heightened awareness and occur frequently in existential writings (Mackler & Shontz, 1965).

(6) *High empathy with external processes and objects.*—Illustrative remarks are:

The sense of the problem as a living thing that is growing toward its inherent solution.

I spent a productive period climbing down my retina, walking around and thinking about certain problems, relating to the mechanism of vision.

Ability to grasp the problem in its entirety to 'dive' into without reservations, almost like becoming the problem.

According to Schachtel (1959), creativity occurs when allocentric (in contrast to autocentric), perception is dominant, i.e., there is openness to the world in its inexhaustible being. Lowenfeld (1947) refers to an intense concern with the environment; with the *tactual space* in which the person is embedded. A number of theorists including Adler, Erich Fromm, Rank, Maslow, and Barron stress that the creative individual is highly sensitive to his environment (Mackler & Shontz, 1965). Two of Murphy's (1963) conditions of creativi-

ty are relevant to empathic communion with the world: receptivity to the outer world and the capacity to love or move outgoingly toward it. *Canalization* or *cathexis* means forming an emotional line of communication from the self to the stimulus value of outer things.

(7) *High empathy with people.*—This may be illustrated with selected comments:

It was also felt that group performance was affected in subtle ways. This may be evidence that some sort of group action was going on all the time.

Only at intervals did I become aware of the music. Sometimes, when I felt the other guys listening to it, it was a physical feeling of them listening to it.

Sometimes we even had the feeling of having the same thoughts and ideas.

Adequate trust and mutuality in interpersonal relations are emphasized in psychoanalytic and self theories of creativity. Rogers (1959) more than any other theorist gives empathy with people a central place in his hierarchy of conditions fostering creativity. It is only through such empathy that the necessary psychological safety and freedom can occur. It is especially central to creative problem-solving in areas that involve interpersonal relationships.

(8) *Accessibility of unconscious resources.*—Comments from *S*s are:

. . . brought about almost total recall of a course that I had had in thermodynamics; something that I had never given any thought about in years.

I was in my early teens and wandering through the gardens where I actually grew up. I felt all my prior emotions in relation to my surroundings.

This is another feature of creativity that has been recognized since early times. Harold Rugg's classic work on *Imagination* (1963) refers to the transliminal experience, the illuminating flash of insight occurring at a critical threshold of the conscious-unconscious continuum. MacKinnon (1964) has elaborated on this concept in order to account for his results of intensive studies of creative individuals. He concludes that the truly creative person is distinguished from the noncreative individual by the greater ease with which he moves from more conscious and active to more unconscious and passive states. His results and interpretation are consistent with psychoanalytic views of creativity, particularly the emphasis on access to preconscious material, primary process activity, and ego regression.

(9) *Ability to associate seemingly dissimilar elements in meaningful ways.*—Sample comments are:

The next insight came as an image of an oyster shell, with the mother-of-pearl shining in different colors. I translated it (into) the idea of an interferometer.

Most of the insights come by association.

It was the last idea that I thought was remarkable because of the way in which it developed. This idea was the result of a fantasy that occurred during Wagner. I put down a line which seemed to embody this (fantasy) . . . . I later made the handle which

my sketches suggested and it had exactly the quality I was looking for. . . . I was very amused at the ease with which all of this was done.

The concepts of Mednick, Koestler, and Guilford described above embrace also the ability to restructure in novel, useful, amusing, or elegant ways. Murphy (1963) refers to this attribute as combinatory skill, the capacity to form structure whether architectural, musical, verbal, spatial, or in other media. Few writers on the creative process have failed to make some reference to the reintegrative element usually present. Mednick (1962) emphasizes that "the more mutually remote the elements of the new combination, the more creative the process or solution."

(10) *High motivation to obtain closure; an appetite for elegance.*—*Ss*' comments may be given:

Had tremendous desire to obtain an elegant solution (the most for the least).

All known constraints about the problem were simultaneously imposed as I hunted for possible solutions. It was like an analog computer whose output could not deviate from what was desired and whose input was continually perturbed with the inclination toward achieving the output.

It was almost an awareness of the 'degree of perfection' of whatever I was doing.

The extensive work on problem solving by the Gestalters led to the concept of closure. Closure is the end product of creative thinking involving changes in the functional meaning, grouping, and reorganization of the items in the field until the gaps and difficulties in the problem are resolved. The field is restructured to restore harmony (Mackler & Shontz, 1965). Closely related to the closure principle, Mackworth (1965) emphasizes the passion for excellence characteristic of original thinkers. Murphy (1963) calls attention to the urge or *will* to create elegant solutions to problems.

(11) *Capacity to visualize the completed solution in its entirety.*—Illustrative examples of *Ss*' comments are:

I looked at the paper I was to draw on. I was completely blank. I knew that I would work with a property 300 ft. square. I drew the property lines. . . . Suddenly I saw the finished project. I did some quick calculations. . . . it would fit on the property and not only that . . . it would meet the cost and income requirements . . . it would park enough cars . . . it met all the requirements.

I visualized the result I wanted and subsequently brought the variables into play which could bring that result about. I had great visual (mental) perceptibility; I could imagine what was wanted, needed, or not possible with almost no effort. In what seemed like ten minutes I had completed the problem . . . I was amazed at my idealism, my visual perception, and the rapidity with which I could operate.

Bertrand Russell once remarked that in the discovery of the theory of relativity, Einstein began with a kind of mystical or poetical insight into the truth which took the form of visualizing the totality of the law in all its ramifications. The Gestalt view conceives creativity as an action which produces a new

idea or "insight" full-formed; it comes to the individual in a flash. Similarly, the illuminating flash of insight in which the completed solution is grasped in its entirety constitutes the most distinctive feature of Rugg's "transliminal experience" and Maslow's "peak experience."

Pragmatic Utility of Solutions

The practical value of obtained solutions is a check against subjective reports of accomplishment which might be attributable to temporary euphoria. The nature of these solutions was varied; they included: (1) a new approach to the design of a vibratory microtome, (2) a commercial building design accepted by client, (3) space probe experiments devised to measure solar properties, (4) design of a linear electron accelerator beam-steering device, (5) engineering improvement to magnetic tape recorder, (6) a chair design modeled and accepted by manufacturer, (7) a letterhead design approved by customer, (8) a mathematical theorem regarding NOR-gate circuits, (9) completion of a furniture line design, (10) a new conceptual model of a photon which was found useful, and (11) design of a private dwelling approved by the client.

The over-all tally, obtained by questionnaire, showed out of 44 problems attempted; 1 on which there had been no further activity for a month or more after the date of the problem-solving session, 20 on which new avenues for further investigation had been opened, 1 on which a developmental model to test the solution had been authorized, 2 on which a working model had been completed, 6 for which the solution had been accepted for construction or production, 10 for which the partial solution obtained was being developed further or being applied in practice, and 4 for which no solution was obtained.

Long-term Enhancement of Creative Ability

The present exploratory study included a relatively short follow-up evaluation 2 wk. after the psychedelic session. Most *Ss* reported significant changes in their modes of functioning which were continuous with the enhancement experienced during the acute phase of the psychedelic state. For example:

> I feel there has been a general improvement, maintained to date, in my ability to concentrate on specific problems, in my visual perceptibility of problems, and a general reduction of inhibitions.
>
> I find that I can dwell upon a problem without distractions creeping in.
>
> I have an energy and decisiveness I have never known before.

Pending more objective, systematic confirmation of possible long-term behavioral changes, these tentative findings suggest that various kinds and degrees of creative abilities tend to persist for a while subsequent to a single psychedelic experience that is conducted according to the carefully structured regimen described above. A significant accomplishment of the present effort was the development of an effective set of procedures for observing the effects of

psychedelic agents on creative problem-solving. Extension of this work should permit a more comprehensive, reliable description of these effects, both immediate and long-term. Specifically, further research should include (1) a larger sample of *S*s who represent more varied specialties within the arts and sciences, (2) an expanded battery of performance tests of creativity which have been pre-tested and have alternate forms, and (3) a second battery of standardized paper-and-pencil tests which may be given before and at various points subsequent to the psychedelic session.

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Accepted May 20, 1966.