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A Paradigm for the Study of Altered States of Consciousness*

By JULIAN SILVERMAN

"When man experiences that certain sequences of mental events lead to behavior which has, as a matter of fact, survival value, he calls such mental facts 'right'. It would be better, however, if instead of this word some neutral symbol were being used for those particular events; because the word 'right' leads to the unfortunate notion that some combinations of mental facts are intrinsically better than others. . . ."

WOLFGANG KÖHLER,
The Place of Value in a World of Facts.

This presentation is concerned with the development of a systematic paradigm for the study of altered states of consciousness such as occur following ingestion of LSD-25 and other psychotomimetic drugs and during acute schizophrenic reactions. Until recently, the main focus of research in this broad area has been upon psychopathology. It has been demonstrated that individuals in these altered states behave unusually on the basis of criteria of social appropriateness. Again and again it has been demonstrated that such individuals also do worse than "normal" subjects on tests of sensory-motor integration, perception and thinking. Unfortunately, these social evaluations and laboratory demonstrations have led to few insights about the psychological and physiological processes underlying abnormal behaviour. It has been impossible to specify to what extent these poorer test performances reflect defects in psychophysiological response mechanisms *or* preoccupation *or* disinterest *or* a different subjective criterion for evaluating psychological test stimuli. This suggests that an explanatory construct, based upon some criterion of accuracy of reality orientation is, by itself, not appropriate for the study of *non*reality-orientated psychological states. Yet, this basis for theorizing about altered psychological states dominates the psychological and psychiatric literature. A research paradigm for the study of abnormal psychological states is needed which is less encumbered by conventional conceptions of "reality", "reality adaptation" and "psychopathology" (Sarbin, 1967).

The term "altered state of consciousness" is an inference from behaviours and verbal reports which are indicative of nonconcensually validated, supernatural, and mystical experiences. In the ordinary waking state subjective events are usually verifiable and explicable on the basis of logically related sequences of events. In an altered psychological state significant deviations in subjective experience and psychological functioning occur; these deviations are from specific norms which apply during the ordinary, alert psychological state (Ludwig, 1966). Individuals in altered states of consciousness (ASC) evidence behaviours which are indicative of the following characteristics:†

(1) Subjective disturbances in concentration, attention, memory and judgment.

(2) Disturbed time sense—subjective feelings of timelessness, and/or acceleration and/or slowing of time occur.

(3) Difficulty in control—the perception of oneself as losing one's grip on reality or losing self-control is common. The experiencing of one's own death is not unusual.

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† The discussion of the list of characteristics of altered states of consciousness is based primarily upon Arnold Ludwig's recent paper on this topic (Ludwig, 1966).

(4) Changes in emotional tone—either emotional extreme, from ecstasy to profound fear and depression may occur. The individual may become detached, uninvolved or relate intense feelings without any emotional display.

(5) Body image change—depersonalization, feelings of derealization or dissolution of boundaries between self and others or between self and the world or universe occur. Depending upon the emotional tone and the individual involved, unusual body image perceptions may be experienced as strange and even frightening *or* transcendental and allowing for expanded consciousness and oneness with the universe.

(6) Perceptual distortions—hallucinations or pseudo-hallucinations may occur (e.g. voices talking to me). Increases in visual imagery or a subjectively felt hyperacuteness of perception are common.

(7) Changes in meaning or significance—unusual meanings or significances are perceived in ideas and experiences. Feelings of profound insight, illumination and truth often occur. This increased sense of significance may lead to false interpretations regarding the motives of others, ideas of reference and other instances of nonconsensually valid cognitions (Ludwig, 1966).

Three major factors, individually or in combination, typically precede the onset of an altered state of consciousness:

(1) "Sensory overload" and "Sensory underload"—either marked increases or marked decreases in exteroceptive stimulation typically associated with profound emotional arousal and "mental fatigue", induce ASCs. Stimuli of ordinary range intensities are experienced more intensely than previously. Paradoxically, pain tolerances often are increased (e.g. Silverman, 1967a). Instances of the altered state effects of sensory overload are observed in religious conversion and healing trance experiences, during revivalistic meetings; in primitive societies, during tribal ceremonies associated with certain *rites de passage*, and shamanistic and prophetic trance states; and during the turmoil associated with the early stages of a schizophrenic reaction (e.g. Eliade, 1964; Ludwig, 1966; McGhie and Chapman, 1961). The altered state effects of "sensory underload" are observed during experimental sensory deprivation states or prolonged social deprivation (e.g. Boisen, 1947; Schultz, 1965).

(2) (a) Hyperattentiveness to a narrow range of sensory and ideational stimuli; and (b) hypoattentiveness to ordinarily responded to attributes of the environment. This behaviour, which is prolonged for hours or days at a time, is associated with such diverse activities as fervent praying, intense mental absorption in a task or on a thought, prolonged attention to the sounds of one's breathing, fixation on stationary objects or objects in motion, e.g. swinging pendulum (Boisen, 1936; Cohen, 1964; Jung, 1960; Ludwig, 1966; Sullivan, 1962).

(3) Changes in body chemistry and in neurophysiological response systems. These changes are found following ingestion of a variety of pharmacological agents such as anaesthetics and the well-known "psychotomimetics" (LSD-25 and psilocybin). They are also found in altered states of consciousness associated with hyperglycaemia (occurring spontaneously or subsequent to fasting) and in certain thyroid and adrenal disorders (Ludwig, 1966).

A Paradigm for the Study of Altered States

Recent studies of individual consistencies in attention and perceptual behaviour, both in non-psychiatric and psychiatric populations, have suggested a new framework within which to examine altered states of consciousness. The elaboration of the framework has proceeded largely on the basis of new advances in the fields of neuro-physiology (both animal and human) and in computer technology. The guiding principle behind the development of this framework, however, dates back to William James's *Principles of Psychology*. James wrote:

> "The practical and theoretical life of whole species, as well as of individual human beings, results from the selection which the habitual direction of their attention involves . . . each of us literally chooses, by his way of attending to things what sort of a universe he shall appear to himself to inhabit."

In the approach to the study of altered states to be elaborated here, the complex process of paying attention is analysed in terms of three attention response factors which regulate reception and utilization of environmental

and internal stimuli (Berlyne, 1960; Köhler and Adams, 1958; Silverman, 1964; Solley and Murphy, 1960). Each of the three response factors is derived from factor analytic studies of sensory, perceptual, cognitive and physiological test responses and from electroneurophysiological studies of sensory functioning in humans (e.g. Buchsbaum and Silverman, 1968; Broverman and Broverman, 1966; Gardner *et al.*, 1959; Gardner, 1961; Messick and Fritzky, 1963; Silverman, 1967a; Silverman *et al.*, submitted for publication). For each of the attention response factors, intensiveness, extensiveness (scanning) and selectiveness (field-articulation), a theoretical construct has been developed. Originally, these constructs were elaborated on the basis of analyses of patterns of test correlations with particular factors. Each attentional construct describes both a response dimension and a hypothetical response mechanism which is postulated to underlie performances on tests which correlate with a factor. Within this framework, a particular constellation of attention response characteristics, which a person evidences, constitutes his "attentional style". The study of individual differences in "attentional styles" is shown to be an especially appropriate approach for the study of normal, reality-orientated consciousness as well as for altered states of consciousness.

The *intensive* aspect of attention refers primarily to responses which individuals make on a stimulus continuum which ranges from very weak to very strong. Two distinctly different but related kinds of psychological and physiological responses define this dimension (*a*) detection and recognition responses to low intensity stimulation (subliminal and marginal) and (*b*) responses to high intensity stimulation. Consideration of both classes of responses and their neurophysiological correlates leads to inferences concerning central nervous system mechanisms which modulate the experienced intensity of stimulation (e.g. Buchsbaum and Silverman, 1968; Petrie *et al.*, 1963; Silverman, 1967a; Silverman *et al.*, submitted for publication). The second attention response factor, *extensiveness* of attention, refers to the degree to which elements in a stimulus field are sampled. It is inferred from certain psychological and physiological laboratory procedures which assess scanning or information-search behaviour (e.g. Benfari, 1966a, 1966b; Gardner *et al.*, 1959; Gardner, 1961; Luborsky *et al.*, 1965; Silverman, 1967a; Silverman and Gaarder, 1967). The third category of attention, *selectiveness* of attention, or "field-articulation" refers to responses which determine which elements in a stimulus field exert a dominant influence on the perceiver. One of the response factors

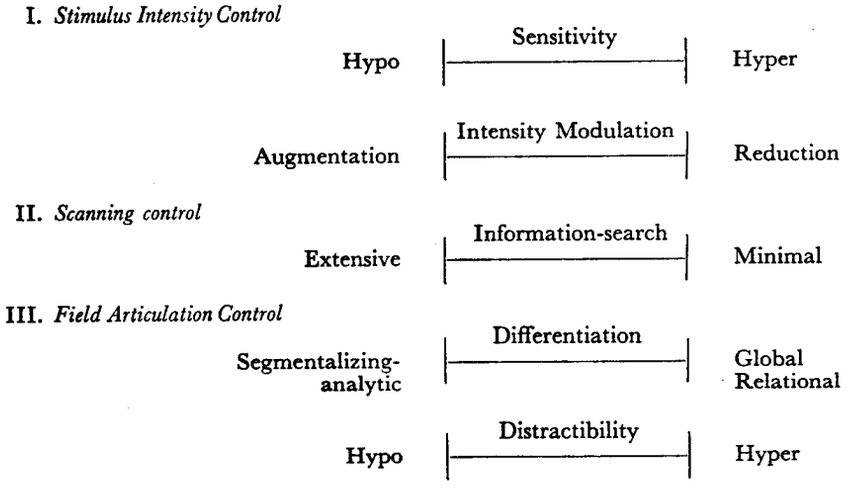

FIG. 1.—Dimensions of attention.

concerned with selectiveness of attention, describes responses to stimulus configurations on a dimension which ranges from passive responsiveness to an overall configuration to responsiveness to discrete segments in a configuration (Messick and Fritzky, 1963; Witkin *et al.*, 1962). The weaker the disposition to segmentalize gestalts, the more likely is an individual to experience stimulus elements in a configuration as related to each other in some concrete manner or as otherwise less differentiated. A second selectiveness of attention response factor describes differences in the degree to which individuals are susceptible to interference from conflicting stimulus elements in a configuration. The more interference prone one is, the greater is one's difficulty in maintaining distinct figure-ground articulations and accurate perceptions and cognitions in the presence of distracting stimulation (Broverman, 1960; Broverman and Broverman, 1966; Erlich, 1955; Messick and Fritzky, 1963).

The Intensive Attentional Factor

There is a paradoxical character to sensory functioning which is dramatically evident among individuals in altered states of consciousness and less readily observed in "normal" subjects (Silverman, 1967a). On the one hand, altered state subjects can be shown to have lowered sensory thresholds and to be overreactive to subliminal or marginal stimulation; they respond more strongly than normals to minimal intensity stimulation (e.g. Fischer, 1966; Fischer *et al.*, 1965; Henkin *et al.*, 1967; Keeler, 1965; Lapkin, 1960; Maupin, 1963). On the other hand, altered state individuals also are found to evidence under-responsiveness to high intensity stimulation, i.e. higher pain tolerances (Kast and Collins, 1964; Kast, 1964; Silverman, 1967a). The most parsimonious explanation for such a paradox was actually stated by Freud (1955) in his concept of "stimulus barrier" and by Pavlov (1957), in his concept of "protective inhibition". That is, individuals who are hypersensitive to low intensity sensory stimulation respond more strongly to it and require a compensatory adjustment (under-responsiveness) to protect themselves from strong stimulation. The significance of the hypersensitivity-hyposensitivity paradox has not been recognized until quite recently even in altered state subjects; this is primarily because of the extraordinary methodological problems involved in conducting sensory threshold studies on these subjects. Most individuals in altered psychological states are preoccupied with aspects of life which have nothing to do with psychophysical experimentation, and they often disregard the specific demands of laboratory tasks. Hence their performances do not reflect their stimulus detection capacities. However, when experimental conditions are arranged so as to establish a *relaxed* and *co-operative* attitude on the part of these subjects, hypersensitivity to stimulation in altered state subjects can be observed. Such experimental findings accord with the subjective reports of psychodelic drug users (e.g. Cohen, 1964), of individuals in the early stages of schizophrenic reactions (e.g. McGhie and Chapman, 1961) and of the retrospective reports of individuals in meditation-induced trances (e.g. Deikman, 1963, 1966):

> "my senses are sharpened";
> "objects stand out vividly in contrast to background";
> "noises all seem louder; everything is much noisier and excites me".

Electroneurophysiological studies of LSD-25 drugged subjects, of nonparanoid schizophrenic subjects, and of normal state subjects which have employed cortical evoked response techniques, are extremely important in this regard (e.g. Buchsbaum and Silverman, 1968; Chapman and Walter, 1964). For they provide an excellent demonstration of a physiological response system which varies its output differently in hypersensitive and nonhypersensitive individuals. The nature of these variations accords beautifully with Freudian and Pavlovian formulations of stimulus intensity control. Briefly, cortical evoked responses are responses to sensory stimulation which are recorded using a modification of standard electroencephalographic procedure. Ordinarily, these responses (evoked electrical potentials) are of such small amplitude as to be obscured by random larger amplitude EEG fluctuations. However, advantage is taken of the fact that an

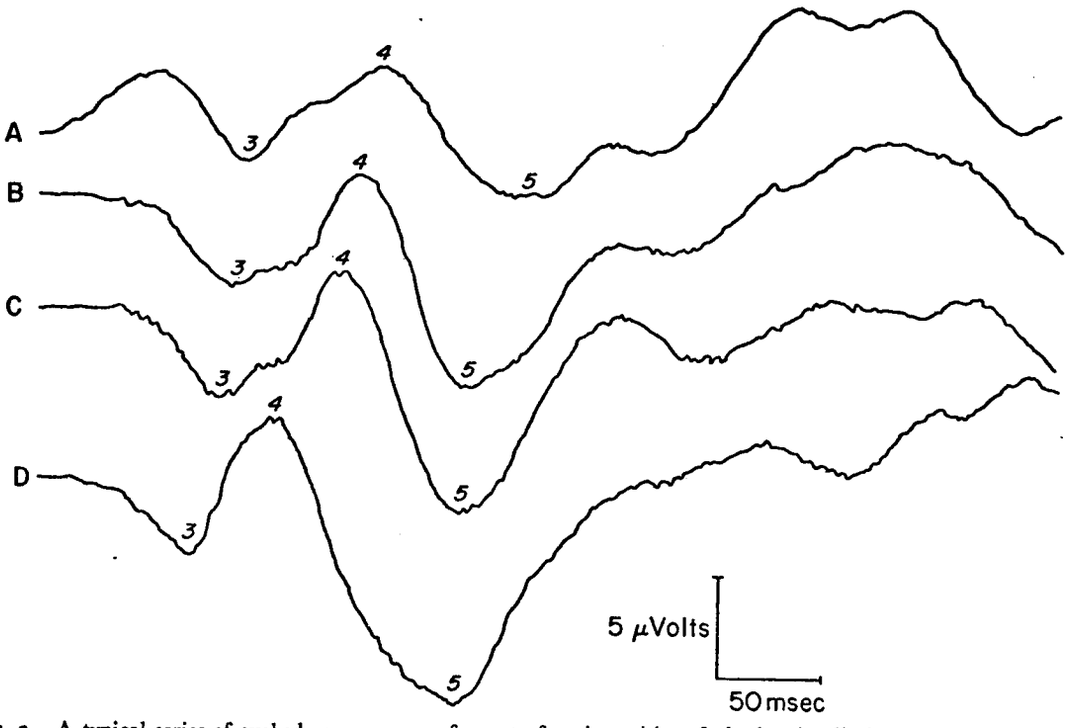

FIG. 2.—A typical series of evoked response waveforms to four intensities of photic stimuli. (From Buchsbaum and Silverman, 1968.)

NOTE.—Peaks are identified by numbers following system of Kooi and Bagchi (1964). Light values in lumen seconds are: A = 32, B = 70, C = 118, D = 980.

evoked response is always related in time to a sensory stimulus (this is not true for random EEG fluctuations). A subject's evoked response pattern is recorded by presenting him with a long series of stimuli, such as light-flashes and for a brief-time interval after each stimulus, summing the EEG, using a computer of average transients. An averaged evoked response wave form (AER) is produced which is similar from person to person to the extent that specific peaks and latencies of the AER wave form can be named and compared.

In a recent experiment by Buchsbaum and Silverman (1968), amplitudes of a particular peak of the photic AER wave form (peak 4) were measured in subjects who had been differentiated into sensory input augmenters, those subjects who amplify incoming stimulation, and sensory input reducers, those subjects who attenuate the intensity of incoming stimuli. The differentiation was made on the basis of research by Asenath Petrie and her colleagues (e.g. Petrie *et al.*, 1963; Petrie, 1967):*

Augmenters, because of their automatic tendency to amplify sensory stimulation, tend to, (1) tolerate pain poorly, and (2) tolerate confinement and isolation well. On a perceptual laboratory procedure called Kinesthetic Figural After-effects (KFA), augmenters over-estimate (or only minimally under-estimate) the size of a "test bar" after rubbing a "stimulation bar" for a period of time.

Reducers, individuals who automatically attenuate sensory stimulation, tend to (1) tolerate pain well, but (2) tolerate sensory depriva-

* The laboratory task on which augmenter and reducer subjects were differentiated was not the same as the one employed by Petrie. The apparatus was different, the duration of the testing session was much shorter and no retesting on another occasion was involved. However, the kind of responses subjects made on both Petrie's and on our procedures were quite similar.

tion situations poorly. On the KFA procedure they evidence marked under-estimations of the test bar after having rubbed the interpolated stimulation bar (see Fig. 3). (It should be noted that in Petrie's formulation three categories of characterological response to sensory input are delineated. Subjects in the third category are termed *Moderates*. These subjects do not show extreme reactions to either pain stimulation or to reduced sensory input situations. Their KFA performances fall between those of augmenters and reducers. In the Buchsbaum/Silverman experiment the third category was not used.)

In the electroneurophysiological part of the experiment subjects' photic evoked responses were averaged for each of four stimulus intensities (ranging in brightness from 32 to 980 lumen seconds). Subjects who evidenced augmenting behaviour on the figural after-effects procedure were found to evidence *higher* response amplitudes at *higher* stimulus intensities than at moderate stimulus intensities. The response amplitudes of the sensory input *reducers* were found to be *lower* at the *higher* stimulus intensities than at moderate stimulus intensities (Fig. 4).

This finding was replicated in both males and females in the course of a subsequent experiment with a sample of comparable age range (19–30 years in the first experiment, 19–42 years in the replication); the correlations between scores on the sensory judgment task and the evoked response procedure were strikingly similar in the two experiments. In a group of college-age reducer, nonparanoid male schizophrenics AER amplitudes to high intensity stimuli were even smaller than those of reducer, nonpsychiatric male subjects (Fig. 5).

The significance of these findings was extended in a study in which nonpsychiatric college students were divided into "high sensitive" and "low sensitive" groups on the basis of performances on tests of auditory sensitivity, brightness sensitivity and thermal sensitivity (Silverman *et al.*, submitted for publication). (The distribution of threshold scores for each

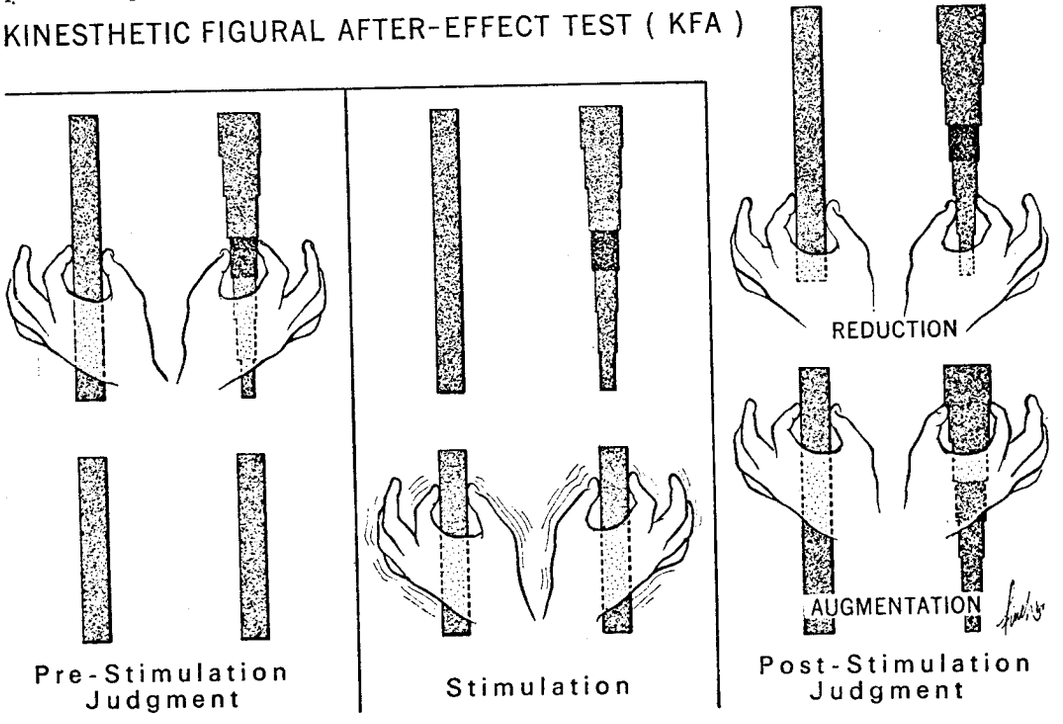

FIG. 3.—Simplified diagram of procedure for determination of augmentation-reduction; from Silverman, Buchsbaum, and Henkin, submitted for publication.

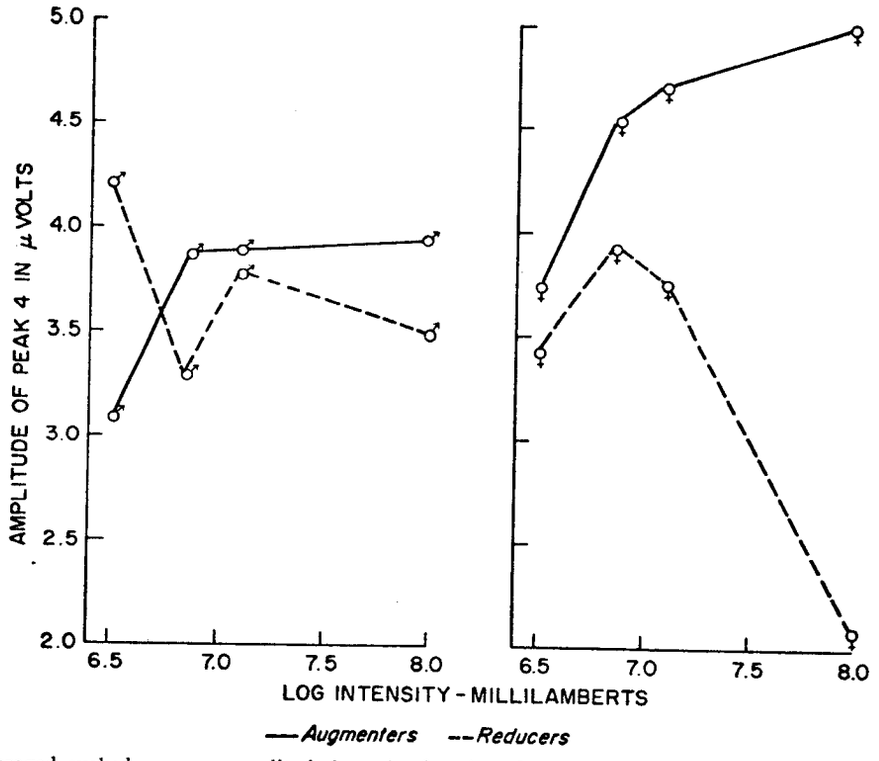

FIG. 4.—Averaged evoked response amplitude-intensity functions for nonpsychiatric augmenter and reducer groups separated by sex. (From Buchsbaum and Silverman, 1968.)

of the three procedures was converted into standard scores, a mean sensitivity standard score was assigned to each subject, and the total sample was divided into two.) For "high sensitive" male subjects, AER amplitudes were found to be smaller at higher stimulus intensities than at lower stimulus intensities; the reverse finding was obtained among subjects whose performances were indicative of lesser sensitivity.* Thus, like the sensory input reducers, sensitive subjects in this study evidence attenuated response amplitudes to the high intensity stimulation on the AER procedure. When these same subjects were recategorized on the basis of sensitivity scores, Petrie augmenting and reducing scores, and on a measure of responsiveness to irrelevant stimuli, a comparable result was obtained. Male subjects with extreme scores, indicative of high sensitivity, stimulus intensity reduction, and hyperresponsiveness to irrelevant contextual stimuli, evidenced the most attenuated evoked response amplitudes to high intensity stimulation.

Studies with psychodelic-drugged subjects and with certain types of schizophrenic subjects have yielded congruent results. On procedures similar to the ones used by Petrie to infer augmentation and reduction, LSD-25 drugged subjects and nonparanoid schizophrenics also evidence sensory input reduction behaviour (Kelm *et al.*, 1963; Kelm, 1962; Kelm and Hall, 1967; Landauer *et al.*, 1966). In a photic cortical evoked response study by Chapman

* The sensitivity/AER effect was not apparent in female subjects. The authors' guarded interpretation of this finding emphasized the fact that the sensory testing extended over a six-week period and that cyclical variations in sensory responsiveness associated with the menstrual cycle confounded the outcome. This interpretation was based largely upon the findings of a number of investigators of systematic changes in sensory responsiveness at different points in the menstrual cycle (e.g. Vierling and Roch, 1967).

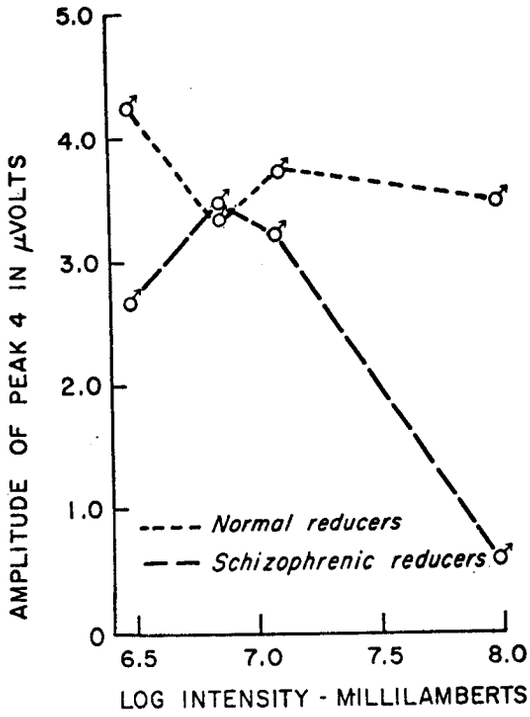

FIG. 5. Amplitudes of averaged evoked responses at four intensities for nonpsychiatric male reducers and schizophrenic male reducers. (From Buchsbaum and Silverman, 1968.)

and Walter (1964), eight of nine subjects evidenced dramatically reduced amplitudes on the various AER wave form components following ingestion of 115μ of LSD. Light flashes were presented at a rate of one every two seconds. Rodin and Luby (1966), using a lower dosage, 1 mg./kg., also obtained a relatively pronounced reduction in AER amplitudes when the light-flash rate was three per second. With smaller dosages of the drug, such effects were not found (Buchsbaum, unpublished study). Dosage effects in photic evoked response studies of cats and of monkeys have been quite consistent with photic AER studies of humans (Key, 1965). Although the techniques in the various AER studies differed somewhat, the main findings of these investigations are predictable on the basis of the stimulus intensity control model. To recapitulate, individuals who evidence sensory input reduction behaviour, as inferred from certain sensory procedures (e.g. Buchsbaum and Silverman, 1968; Kelm *et al.*, 1963) also evidence reduction behaviour on a neurophysiological procedure (e.g. Chapman and Walter, 1964). These individuals actually are hypersensitive to low-to-moderate intensity stimulation (e.g. Fischer *et al.*, 1965; Keeler, 1965; Maupin, 1963). They respond to stimulation of minimal intensity more strongly, and they require a compensatory adjustment (underresponsiveness) to protect themselves from strong stimulation. Unusual hypersensitivity appears to be a precondition for an altered state of consciousness experience.

THE EXTENSIVENESS OF ATTENTION FACTOR

The extensiveness with which the environment is searched or scanned for information is different in ordinary-waking states and in altered states of consciousness. An individual in an altered state of consciousness is preoccupied with a very narrow circle of ideas;

the range of environmental stimuli to which he responds in a systematic way is constricted markedly. Partly because of this, the investigator is often unable to control the attributes of laboratory test stimuli to which the altered state subject attends. Nevertheless, with the development of sophisticated techniques for measuring visual scanning behaviour (e.g. Gaarder *et al.*, 1967; Mackworth, 1967), it has become possible to study the extensiveness of attention factor, even in withdrawn and non-communicative subjects.

The original elaboration of the scanning construct with ordinary-waking state subjects was presented in a series of papers by Riley Gardner and his colleagues at the Menninger Foundation (e.g. Gardner *et al.*, 1959). In their studies of size estimation behaviour, a significant correlation was obtained between magnitude of size estimations and number of eye-movements (looks) during the size judgment procedure (Gardner and Long, 1962). Few looks at a standard stimulus, measured by an electro-oculographic recording device, was associated with size over-estimation. A large number of looks at the standard was associated with size under-estimation.* In their factor analysis of a large battery of perceptual and cognitive procedures, the Gardner *et al.* size estimation task and a measure of size constancy were found to load quite highly on the same factor. (The essential difference between the size judgment and size constancy procedures is that, in the former, standard and variable stimuli are presented at approximately the same distance from the subject's eye; in the latter procedure standard and variable stimuli are presented at different distances from the subject's eye.) The factor analysis findings suggested that a possible significant determinant of size constancy performance was the extent to which the subject looked back and forth between standard and variable stimuli. Indeed the effects of such a factor on size constancy judgments had been elaborated upon earlier by Piaget (1950). Piaget noted that in young children, attention appears to centre upon dominant objects in the stimulus field. This automatically causes young children to over-estimate the sizes of objects which are near (dominant) relative to objects which are further away. Adults on the other hand, over compensate for this kind of "centration effect" by increasing the rate of looks back and forth from near to distant objects. Ordinary waking state adults tend to over-estimate the distant object apparently because they "centre" more upon it.

It would be expected that altered-state subjects who appear to minimally attend to their surroundings, would on size judgement procedures evidence over-estimation of standard stimuli and on size constancy procedures evidence over-estimation of nearer stimuli. On the other hand, subjects who extensively sample environmental stimuli would be expected to evidence judgment errors in the opposite directions. The results of studies with these procedures have accorded quite well with the expectations (e.g. Carlson, 1962; Davis *et al.*, 1967; Silverman, 1964, 1967a); they have provided excellent construct validity for the procedures as measures of perceptual orientation on an inwardly-oriented-outwardly-oriented continuum. Minimal scanning behaviour, inferred from the above-mentioned procedures, is found to be characteristic of nonparanoid, "essential" types of schizophrenics; these individuals are typically inwardly oriented and withdrawn from their environments. Extensive scanning behaviour inferred from the same procedure is found to be characteristic of paranoid schizophrenic subjects; these individuals are typically outwardly oriented. The two schizophrenic prototypes differ in the forms which their altered state experiences take. In the acute nonparanoid or "essential" schizophrenic state, the individual may undergo the profoundest of emotional upheavals, often with abounding religious and magical ideation, in a markedly detached (minimal scanning) manner. He is beyond commonplace acts, he may not talk, he may

* Confirmation of the relationship between number of "looks" and magnitudes of size estimation was obtained in a recent unpublished study at the National Institute of Mental Health of ordinary-waking state subjects. A significant correlation was found between the number of eye movements made during inspection of a simple stimulus array and magnitudes of size estimation on the Gardner *et al.* procedure. Eye movements were recorded with a Mackworth eyemarker camera (Mackworth, 1967).

not even recognize the personal meaning of other people's actions. "He seems to be living in the midst of a struggle between personified cosmic forces of good and evil" (Sullivan, 1953, p. 151). In the paranoid schizophrenic resolution of an altered state experience, the individual ". . . caught up in the spread of meaning, magic and transcendental forces, suddenly 'understands' it all as the work of some other concrete person or persons" (Sullivan, 1953, p. 153). His direction of attention is thereafter primarily upon environmental events and people.

Scanning behaviours, comparable to those of the nonparanoid schizophrenic type, also are inferable from perceptual studies of LSD-drugged subjects. For example, in a size constancy experiment by Carlson (1962), under-constancy, indicative of minimal scanning, is found in a group of nonpsychiatric subjects who ingested 75μ of LSD.

Studies of saccadic eye movements have provided another source of information regarding extensiveness of attention in different states of consciousness. Saccadic movements are rapid, flick-like jumps of the eye which occur on the average between once and twice a second, even when a subject is fixating a minute portion of the visual field. Ordinarily, these movements are considered to be essential for detailed vision (Dichtburn and Fender, 1955). Among ordinary-waking state subjects, a significant correlation is found between magnitude of size judgement and saccadic rate during fixation of a target image (Silverman and Gaarder, 1967). Under-estimating—extensive scanning subjects—tend to have higher saccadic rates than over-estimating, less extensive scanning subjects. However, among altered state subjects such as LSD-drugged subjects and nonparanoid schizophrenic subjects, minimal scan-

TABLE I

Two Types of Altered States of Consciousness Associated with the Diagnostic Term Schizophrenia
(From Silverman, 1967c)

Stage of disorder	Essential schizophrenia (Nonparanoid)	Paranoid schizophrenia
I. Preconditions; fear; feelings of impotence and failure; guilt; high physiological arousal	[same in both]	
II. Preoccupation; isolation; estrangement	[same in both]	
III. Narrowing of attention; self initiated sensory restriction	[same in both]	
IV. Perceptual-Cognitive Reorganization: Regression; religious and/or magical ideation	Themes of death and rebirth *quite* common	Themes of death and rebirth *less* common
V. Perceptual-Cognitive Reorganization: (Change in problem solving orientation in paranoid type)	Concentration upon internal "other world" events	Sudden "understanding" Objectification of the "spread of meaning"
	Impersonal, detached orientation toward the world. Relatively minimal scanning of the environment	Objectified orientation to the world. Extensive scanning of the environment

ning behaviour is not associated with lower saccadic rates. Rather, altered state, minimal scanning subjects have extraordinarily high saccadic rates. Laboratory studies by Hebbard and Fischer (1966) and Kohn and Bryden (1965) of LSD and psilocybin-drugged subjects clearly indicate dramatic increases in saccadic rate within two hours after ingesting substantial dosages of these drugs. In studies by Shimazono *et al.* (1965) and by Wallach and Wallach (1964) unusually high saccadic rates are found among schizophrenic subjects.

It appears that the unusually large numbers of fine eye movements of psychodelic drugged and essential schizophrenic subjects are concentrated in a relatively restricted portion of the visual field. Under these conditions redundancy of information sampling is pronounced. The combination of response tendencies of (1) minimal scanning and (2) high redundancy of information sampling (high saccadic rate) leads to pronounced size over-estimations (Neale and Cromwell, in press; Pribram and Melges, in press). This same combination of response tendencies also may be responsible, in part, for reports by many altered state subjects, of an increased clarity of vision. Restriction and concentration of attention upon a small segment of the physical environment and a concomitant high saccadic rate apparently causes the brightnesses of objects to be increased and their physical properties to be accentuated (Deikman, 1966; Hollister and Hartman, 1962; Keeler, 1965; Turner, 1963).

High saccadic rates also appear to affect perception in the vertical plane to a considerable extent. In an experiment by Kohn and Bryden (1965), employing a stabilized retinal image procedure, increases in saccadic rate following ingestion of LSD-25 (1 μ/kg.) were found to alter the visibility of vertical parallel lines; little change could be detected in the perception of horizontal parallel lines. In a series of experiments by Krus, Wapner and their colleagues (e.g. Krus *et al.*, 1966) differences in perception in the vertical plane were reported between groups of ordinary-waking state subjects as compared with groups of nonparanoid schizophrenic subjects and LSD-25-drugged subjects. The subjects in these experiments were asked to set a marker line at a position in physical space which was experienced as being at eye level. Objective eye level was determined for each subject by measuring the height of the subject's pupils above the floor. Among ordinary-waking state adults the apparent eye level typically is located at a position which is below objective eye level. Among nonparanoid schizophrenic subjects and LSD-25-drugged subjects apparent eye level is located at a position which is *above* objective eye level. Furthermore, with LSD-25-drugged subjects, increasing dosage levels are found to be linearly related to increases in the height of apparent eye level above objective eye level. This latter finding is consistent with one by Hebbard and Fischer (1966) of increases in psychodelic drug dosages being related to increases in frequency of small eye movements (see Table II).

Other related researches have suggested a rather interesting parallel between the behaviour of individuals in awake altered psychological states and of individuals in the dream-sleep state. In all of these conditions, electroencephalogram recordings suggest unusually high cortical activation (e.g. Lerner, 1967; Pfeiffer *et al.*, 1965; Silverman, 1967a), and in all of these conditions eye-movement rates are unusually high (e.g. Dement and Kleitman, 1957; Silverman and Gaarder, 1967).* Indeed, as would be expected by the results of the saccadic rate studies mentioned above, LSD is found to increase dream-sleep time, that is, Rapid Eye Movement, Low Voltage fast EEG activity during sleep (Green, 1965; Muzio *et al.*, 1966).

In a recent pilot study the relationship between (1) rapid eye-movement rate (REMs) during dream-sleep, (2) saccadic eye movement during waking, and (3) size estimation judgments were studied in four chronic schizophrenic patients (Snyder *et al.*, unpublished study). The four subjects were selected for the sleep study on the basis of their saccadic eye-movement rates and size judgments, either being extremely low (or small) or extremely high (or large). REM sleep scores, averaged

* These response characteristics are reported to be associated with dreaming (e.g. Dement and Kleitman, 1957).

TABLE II

Effect of LSD-25 at Different Dosage Levels on Position of Apparent Eye Level in Normal and Schizophrenic Adults
(From Krus *et al.*, 1966)

Means (cm.)			
Normals (N = 12)		Schizophrenics (N = 9)	
Placebo	−9·4*	Placebo	+9·8
40μg LSD	−0·6	75μg LSD	+12·0
75μg LSD	+6·6	150μg LSD	+16·9
F (conditions) significant at <0·01		F (conditions) significant at <0·05	

* A plus score indicates position above, a minus score indicates position below objective eye level. Measurements taken approximately two hours following oral ingestion of drug (placebo).

over three nights, of the four subjects were found to coincide in all cases with their size judgments and saccadic rates. The highest amount of REM time was found in the schizophrenic subject with the highest saccadic rate during waking and the highest size estimation score, i.e in the minimal scanner. The lowest amount of REM time was found in the schizophrenic subject with a normal range saccadic rate and a marked under-estimation size judgment score. While it would be premature on the basis of these data to speculate about the nature of a relationship between waking scanning behaviour and scanning during dreaming (see Dement and Kleitman, 1957), the possibility of such a relationship is suggested by the above-mentioned result.

A final interesting similarity between all of these altered states is the occurrence of visual imagery. Unusual clarity of vision and hallucinations during waking and dream images during sleep all are associated with the same psychophysiological response—a high rate of eye movement.

SELECTIVENESS OF ATTENTION

The field-articulation responses of hypersensitive individuals, especially those in altered psychological states, tend to be, (*a*) global and diffuse rather than analytic, and (*b*) strongly affected by minimal changes in internal and external stimulus conditions. In altered states of consciousness momentary fluctuations in attention are completely unpredictable. A sustained focus of attention upon external stimulus patterns and at times upon internal stimulus events as well, is a virtual impossibility (e.g. Bleuler, 1950; Chapman, 1967; Hoffer and Osmond, 1966; Lienert, 1966; Paul, 1964; Wikler *et al.*, 1965; Wapner, 1964; Silverman, 1967a). Associated with this fluid perceptual orientation is the surging into consciousness of unusual and portentous ideas and imagery which are ordinarily held in check (e.g. ideas of cosmic importance, imagery of overpowering beauty or ugliness). R. D. Laing (1960) calls this kind of experience the "implosion" of reality. Deikman (1966) writes in this connection of a *deautomatization* of the psychological mechanisms which "organize, limit, select and interpret perceptual stimuli" (p. 329).* Thinking is grossly subjective and egocentric; concepts are experienced as percepts. Causal relationships may be perceived between the most distantly related of events; everything is capable of being connected with everything else in an irrational manner.

Studies of ordinary waking-state individuals provide support for a formulation that underlying differences in field articulation are differences in (*a*) sensitivity to stimulation, (*b*) stimulus intensity control, and (*c*) "stimulus-bound" or "concrete" behaviour. Kaswan *et al.* (1965) found that subjects low in field-

* Deikman's formulation, derived from clinical-experimental and psychiatric studies, is quite similar to the Brovermans' (1966) factor analytically derived concept of automatization.

articulation (field-dependent), who were especially distracted by background stimulation of a tilted luminous rod, evidenced greater sensitivity on a signal detection task. On the other hand, individuals not influenced by the background stimulation of the frame, high field-articulation (field-independent) subjects, tended not to evidence sensitivity on the Kaswan *et al.* signal-detection task. Judgments of the vertical by the high field-articulation subjects were less affected by and less dependent upon external stimulus determinants. Allison (1963) found that subjects evidenced greater sensitivity to low intensity stimulation when they were given instructions to respond to the task stimuli in a non-analytical, low field-articulation fashion. A comparable result was reported by Fiss (1966).

Evidence suggesting a disposition toward reduction of the experienced intensity of stimulation in low field-articulation (field-dependent), normal-state subjects is found in studies by Immergluck (1966) and in studies by Cohen *et al.* (1963), Culver *et al.* (1963) and Hein *et al.* (1964, 1966). Cohen *et al.* recorded the Galvanic Skin Response (GSR) of non-psychiatric subjects under two quite different levels of stimulus intensity, during a "sensory deprivation" condition and during a conditioning experiment employing electric shock. Previous researches (e.g. Howe, 1958; Israel, 1966; Lynn, 1963) had indicated that the stimulus intensity control formulation could explain certain heretofore incomprehensible results on GSR conditioning and habituation (Silverman, in press). In the "sensory deprivation", low intensity input condition, non-analytical, field-dependent subjects evidenced higher GSR levels (greater reactivity) than field independent subjects. In the high intensity input condition, this finding was reversed; here, field-dependent subjects evidenced the lesser amount of galvanic skin responsiveness. Such a finding is consistent with the other researches reviewed here: individuals who evidence non-analytical, undifferentiated perceptual responsiveness on field-articulation tasks evidence (*a*) greater sensitivity to stimulation on signal detection tasks (Kaswan *et al.*, 1965), and (*b*) attenuated responsiveness to high intensity stimulation on a measure of physiological reactivity. In the high stimulus intensity condition, the nonanalytical field-dependent subjects also were found to evidence significant heart-rate decreases (cardiac deceleration) following stimulation (Hein *et al.*, 1966). Cardiac deceleration has been interpreted by Lacey (1966) as being associated with "lowered sensory thresholds". Hein regarded such decelerative responses as signifying a marked degree of "stimulus boundedness". Consistent with these interpretations is evidence indicating that subjects exhibiting cardiac deceleration respond more strongly than others to sensory attributes of stimuli relative to connotative attributes of stimuli (Silverman, 1967a). This combination of relatively undifferentiated perceptual and cognitive responsiveness and heightened sensitivity also has been reported as being characteristic of subjects in mystical states (Deikman, 1963, 1966), under the effects of LSD-25 (e.g. Cohen, 1964) and during the incipient stages of schizophrenic reactions (e.g. McGhie and Chapman, 1961). In these states, "the active intellectual style is replaced by a receptive perceptual mode . . . the undoing of automatic perceptual and cognitive structures permits a gain in sensory intensity and richness at the expense of abstract categorization and differentiation" (Deikman, 1966, pp. 329 and 331).

Under these conditions, information processing is less efficient from an *ordinary*, waking state point of view but "this very inefficiency may permit the experience of aspects of the real world formerly excluded or ignored" (Deikman, 1966, p. 338). It is certainly noteworthy that a comparable orientation to environmental and internal events is reported to occur among individuals during the early stages of creative activity (Frijling-Schreuder, 1966; Klein, 1958; Murphy, 1958; Schachtel, 1959; Silverman, 1967b; Szekely, 1967).

"The *quality* of the encounter that leads to creative experience consists primarily in the openness during the encounter and in the repeated and varied approaches to the object. . . . This openness means that the sensibilities of the person, his mind and his senses, are more freely receptive, less tied to fixed anticipations and sets, and that the object is approached in different ways, from different

TABLE III

Attentional Response Characteristics Associated with the Ordinary-Waking State and with Altered States of Consciousness

Response dimension	Ordinary-waking state	Altered states of consciousness	References
I. Stimulus intensity control	(1) Midrange sensitivity	(1) Hypersensitivity	Silverman, 1967a Fischer *et al.*, 1965 Keeler, 1965
	(2) Either augmentation or reduction of the experienced intensity of stimulation	(2) Pronounced reduction of the experienced intensity of stimulation (e.g. high pain tolerance)	Buchsbaum and Silverman, 1968 Kast and Collins, 1964 Chapman and Walter, 1964
II. Scanning control	(3) Balanced scanning of the environment	(3) Minimal scanning of the environment	Carlson, 1962 Silverman, 1964
	(4) High saccadic rate associated with balanced scanning	(4) High saccadic rate associated with minimal scanning	Hebbard and Fischer, 1966 Silverman and Gaarder, 1967
III. Field articulation control	(5) Active, analytical-segmentalizing perceptual responsiveness	(5) Passive, global-relational perceptual responsiveness	DeLuca, 1967 Levine *et al.*, 1955* Witkin, 1965
	(6) Capacity for shifting and sustaining a focus of attention on varying external stimulus patterns	(6) Inability to shift and to sustain a focus of attention upon varying external stimulus patterns	Shakow, 1962 Wapner, 1964 Wikler *et al.*, 1965

* A tendency to "passively attend" to elements of stimulus configurations (Bleuler, 1950; James, 1890) and to experience even apparently unrelated elements as related to each other, is an outstanding attribute of altered state subjects. Perhaps because this attribute is so impressive in psychodelic drug states, there have been few experimental studies of it.

angles, and not with any fixed purpose. . . ." (Schachtel, 1959, pages 241–245).

Reputable reports of the psychologically constructive effects of perceptual "openness" in altered states of consciousness are common (Batman *et al.*, 1966; Deikman, 1966; Pahnke, 1967; Sasaki, 1968; Silverman, 1967b).

"*Attentional Style*" *and the Altered State Experience*

The overall pattern of attentional response and psychological state relationships which has been elaborated here indicates clear-cut associations between "styles" of paying attention and the experience of "reality" (Table III).

This approach to the study of psychological functioning has two principal advantages over previous ones: (1) it provides an empirically derived, multi-dimensional framework for the study of behaviour in ordinary-waking states and in altered states of consciousness, and (2) it avoids the pitfalls of inferences based on inadequate comparisons between abnormal behaviour and behaviour which occurs in the normal-waking state (see, for example, Sarbin, 1967). Such an approach greatly facilitates investigation of the processes underlying abnormal behaviour and experiences. It also makes possible systematic investigation of the potentially constructive aspects of altered states of consciousness.

Summary

This presentation has been concerned with the elaboration of a paradigm for the study of altered states of consciousness. Emphasis has been placed upon the differentiation of ordinary-waking state and altered state behaviour-types in terms of patterns of physiological, sensory and perceptual responses. Prototypic differences in psychophysiological response characteristics, indicative of differences in "attention styles", have been described between ordinary-waking state subjects and schizophrenic subjects, LSD-25 drugged subjects and individuals in certain other altered states of consciousness.

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