

CHAPTER VI

SUMMARY AND CONCLUSIONS

The study of consciousness and ASCs gained scientific acceptability and recognition only within the past decade. ASCs as represented by mystical states, meditation, psychosis, psychedelic drug use and in temporal lobe epilepsy involved a qualitative shift in the pattern of mental functioning (Tart, 1972) with reported profound results on the religion, philosophy, life style, physiological functioning and psychological working of the individual. ASCs may serve as "adaptive or maladaptive outlets" (Ludwig, 1966) and their consequences in terms of further growth, actualization and integration on the one hand, and pathology and non/dis-integration on the other hand have been emphasized.

As Creutzfeldt and Rager (1978) maintained scientific investigation of a special subject does not need a philosophical justification. Its justification lies in the adequacy of the method to its objective. In discussing ASCs the epistemological dangers of a psychological approach are most apparent. The difficulty of relating and defining the acts which represent and lead to ASCs and conscious experience in general have been well documented.

For the purpose of study of the behavioral and psychophysiological correlates of ASCs, four broad parameters of information were selected and these were experiential, electrocortical, psychophysiological and psychological test datum. Four groups of subjects were selected. The first was the Meditation group which consisted of individuals who had formal and informal spiritual and religious training in diverse meditative disciplines. ASCs associated with the practice of meditation were rated on two sets of criteria (Ludwig, 1966; Tart, 1975) which were a part of the Information Schedule. The second group was the Schizophrenic group where the ASC was experienced at the inception of the psychosis and this constituted the psychiatric non-integrative group. Psychotic ASCs were evaluated by the criteria of Bowers and Freedman (1966). The TLE group constituted the third group where the TLE aura (characteristics provided by Penfield and Jasper, 1958) and the interictal TLE behavior (characteristics given by Bear, 1977) facilitated the recognition of the ASC. A Normal control group was also chosen (by using Goldberg's, 1972, General Health Questionnaire) to enable comparison of basal levels and also to assess whether some of the physiological changes accompanying the Meditative ASC were the natural accompaniment of relaxation in normal controls. While speaking of "correlates" of ASCs it becomes necessary to sort out physiological and psychological states which are related to ASCs either as necessary conditions or as

incidental accompaniments. Partly, the resolution of this problem lies in the methodology adopted, for only the EEG was recorded during meditation (and a session of meditation does not necessarily presuppose the occurrence of a Meditative ASC), while all other testing was done when subjects were in their normal waking state of consciousness.

The tools and techniques of investigation included the Information Schedule for experiential information which dealt mainly with the nature and characteristics of the experienced ASC, recording of the EEG using the 10-20 electrode system and both monopolar and bipolar montages for obtaining electrocortical data as well as the use of certain psychological tests which were indicants for cortical arousal. For psychophysiological information, respiration rate, heart rate, blood pulse volume, muscle tension, and electrodermal activity were recorded to obtain tonic levels and electrodermal responsivity was also assessed. The psychological test information induced measures of field dependence - independence (Rod and Frame Test, Embedded Figures Test), divergent-convergent thinking (Nonverbal Test of Creativity, Advanced Progressive Matrices), sustained attention (Vigilance task), and conceptual organization (Index of Clustering in Recall).

The information obtained on these broad parameters (excluding experiential information) was subjected to three statistical procedures: Analysis of Variance,

Correlation Matrix and Multiple Discriminant Analysis (on certain selected variables). Experiential information was analyzed separately.

The hypotheses formulated had stated that each of the four broad parameters would manifest distinct patterns in each of the four groups. For electrocortical (EEG) variables this hypothesis was borne out on a limited number of variables. For the Meditation group there was increased alpha frequency at the basal level which decreased during meditation. Alpha amplitude showed a decrease during meditation. There was evidence of increased involvement of the right hemisphere during meditation and significant increases in theta frequency and amplitude were indicative of meditation being a state of relaxation and decreased cortical activation as compared to the premeditation stage. The postmeditation stage showed the "cortical sensitization" effect. The meditation specific changes included decreases in alpha frequency, voltage and index, an increase in occipital alpha frequency and voltage as well as increases in theta frequency and voltage. The electrocortical indices indicated increased alpha voltage and index for the Schizophrenic group at the basal level as well as high theta frequency and voltage. The high voltage may be due to the action of the phenothiazines (CPZ) administered to the patients. This was indicative of a state of relaxed wakefulness. The behavioral measures of arousal, however, showed a decrement in physiological but not cognitive arousal for

the Meditation group, while for the Schizophrenic group as indicated by performance on Spiral After Effect and Reaction-time tasks there was increased arousal indicating a dissociation between behavioral and electrographic arousal for this group in particular. For the TLE group the EEG correlates included lowered alpha frequency, voltage and index and high theta frequency and voltage. The behavioral measures also indicated a state of quiescence. For the Normal control group, alpha frequency and voltage was found to be high and particularly in comparison with the Meditation group there was increased alpha and theta voltage in the monopolar leads at the basal levels. The Normal group also performed poorly on the RT tasks and correlational data indicated complex relationships between the electrographic and behavioral indicants of cortical arousal.

On the psychophysiological variables, significant differences were obtained only for skin conductance level. Trends indicated that the Meditation group had the lowest autonomic arousal and the Schizophrenic group the highest autonomic arousal.

The psychological test data also provided support for the hypothesis that postulated that distinct patterns of psychological functioning would be apparent for each of the four groups. Thus the Meditation group showed greater psychological differentiation with a higher degree of integration and overlap of fundamental functions as well as mobile differentiation with the

connotation of an ability to shift between diffuse and integrative cognitive styles. The group also performed well on the Advanced Progressive Matrices indicating good analytic and integrative skills and in the Creativity Test, performed equally well on both verbal and nonverbal aspects of originality and Flexibility. This indicated an involvement of cognitive functions developed through the permanent integration of primary and secondary process styles. Another characteristic of this group was the ability to maintain sustained arousal and attention and the ability to organize recall particularly at the longer time intervals.

The Schizophrenic group showed great variability in tests of field dependence - independence and the largest number of field independents and provided evidence that increased parasympathetic nervous system functioning would alter the activation-inhibition balance in the direction of greater inhibition facilitating performance of such tasks. Further, the Schizophrenic group performed poorly on verbal aspects of creativity indicating possible left hemisphere dysfunction, while an average performance was found on the convergent-thinking task. Regarding clustering in recall the schizophrenics did poorly with the deficit most apparent at the longer recall intervals with the implications that there was inefficient coding for eventual retrieval. The vigilance task also showed a deficit as

a consequence of competing stimuli interfering with the registration of the critical stimuli.

The TLE group as a whole showed poor psychological differentiation, poor performance on tasks of convergent and divergent thinking, a deficit in the ability to organize recall indicating an impairment in encoding, retrieval and organization in memory and an average ability to detect signals.

The Normal group evinced the greatest psychological differentiation, indicating a high degree of differentiation of functions. As a group they displayed a proficiency in analytical ability as well as on aspects of creativity (elaboration-nonverbal and originality - verbal). They also showed the ability to efficiently organize recall and their performance was superior at the short time intervals. This group also showed the typical vigilance decrement in performance.

The Multiple Discriminant Analysis was done with a limited number of variables (20 out of a total of 74) and succeeded in differentiating between the groups. The variables with positive coefficients which contributed maximally to discriminating between the groups were conceptual organization, field independence, cortical arousal (both behavioral and electrographic measures), creativity (nonverbal measures) and convergent thinking. Between the groups, differences in the relative contributions of different coefficients were

found on sustained attention (contributed maximum variance to the Meditation group), cortical arousal (Complex RT: maximum variance in the Schizophrenic group), originality-verbal and alpha amplitude, right hemisphere monopolar leads.

From a comparison between pairs of groups the following conclusions were reached: between the Meditation and Schizophrenic groups it was clear that the latter had higher scores on indices of cortical and behavioral arousal; between the Meditation and TLE groups superior performance on convergent-divergent thinking and organization of memory tasks was characteristic of the Meditation group, compared to the Normal group, the meditators had higher scores on indicants of behavioral and cortical arousal and superior vigilance performance; among the clinical groups, the schizophrenics were superior on divergent thinking and memory tasks and had higher arousal; compared to the Normal group, who had higher creativity scores, increased cortical arousal was found in the Schizophrenic group; the normals were superior on convergent-divergent thinking tasks, while increased autonomic arousal was characteristic of the TLE group.

The experiential data analysis revealed that the core-criterion common to all ASCs was the phenomenon of perceptual distortion. The Meditative ASC was characterized by body image change, disturbed time sense, change in emotional expression, change in meaning and significance,

and feelings of rejuvenation. The **Epileptic ASC** was characterized by perceptual illusions and hallucinations and the **Psychotic ASC** by body image change, change in meaning and significance, disturbed time sense, alterations in thinking and hypersuggestibility. This enabled accepting of the hypothesis that each **ASC** would have its own distinctive pattern.

Regarding the possible mechanisms underlying the adaptive - maladaptive or integration - nonintegrative consequences of **ASCs**, sufficient differences between the groups on the different behavioral parameters were obtained to posit these with a modicum of assurance. An important mediator appears to be the temporal lobe. Briefly the mantra hypothesis of Glueck and Stroebel (1975) postulated that the mantra was a driving mechanism which dampened limbic circuitry with attendant changes in the peripheral nervous system and a freer interchange of information between hemispheres. For the Meditation group this hypothesis found applicability in the trends toward increased theta frequency and voltage during meditation, decreased autonomic arousal and evidence of increased right hemisphere activation during meditation. Both schizophrenia and TLE have been regarded as antithetical manifestations of disturbances in the temporo-limbic system (Symonds, 1962) and a focal temporal abnormality has been held to be important for the etiology of schizophrenia (Flor-Henry, 1976) while Gruzelier (1978) posited a disorder of attentional

processes located in the temporal-limbic systems. Deep temporal stimulation produced subjective euphoria and increased alertness (Stevens et al., 1969) and cholinergic mechanisms were adduced to be responsible for TLE and adrenergic mechanisms for ASCs. Thus Mandell (1980) suggested the possibility that there is a biogenic amine - temporal lobe - limbic neurology for ASCs.

Many studies have focused on the integration and harmonious working of the two hemispheres of the brain (e.g., Gazzaniga and Le Doux, 1978). On all tasks requiring an integration of the functions of the right and left hemispheres, the Meditation group has shown a marked superiority over both the clinical groups. These include performance on creativity, more mobile field differentiation and decrease in R/L Ratio during meditation. The other groups have shown impaired performance in these tasks and in particular the Schizophrenic group performed poorly on verbal aspects of creativity suggesting a left hemisphere dysfunction (Gur, 1978).

Attentional deficits in the form of difficulty in registration, encoding and retrieval of information may account for the impairment or both the clinical groups on certain tasks (Reaction - Time, Vigilance, Index of Clustering in Recall).

The main contention of this thesis was thus borne out that optimal functioning (Coan, 1974)/ self actualizing (Maslow, 1964) did not involve superior functioning

at psychological, physiological and cognitive levels. Actualizing or integration involved a balance, integration and interaction. In many cases the Normal group performed as well as the Meditation group; the schizophrenic deficit on tasks was not always apparent; but subtle differences demarcated the groups. The Meditative ASC was experientially characterized by perceptual and cognitive changes in an atmosphere charged with positive emotional effect, there were indications of high cortical arousal, as well as the ability to shift from high to low levels of arousal (high cortical arousal prior to meditation which decreased during meditation) and lowered autonomic arousal with adequate responsivity to stimuli. This flexibility was again evident in mobile field differentiation, higher creativity scores on originality, more efficient deployment of right hemisphere resources. Also sustained attention was found to be good, as well as the ability to organize memory at longer time intervals. Conventional analytical methods of thinking were successfully combined with more unusual, primary process material for creativity and originality in thinking.

The nonintegrative ASCs were characterized by perceptual distortions, changes in cognitive functioning and the predominant affective context was one of fear, uncertainty and apprehension. Decreased and lowered cortical arousal was associated with higher behavioral arousal (a dissociation between electrographic and behavioral arousal) and increased autonomic arousal.

Field differentiation was found to be more rigid and extreme in the direction of increased field-independence (schizophrenics) and field dependence (TEs). Attentional deficits, difficulty in clustering, poor vigilance performance were also evident.

Further work and research may throw more light on the interplay of variables and mechanisms underlying the different ASCs.

LIMITATIONS

The following limitations were inherent in the study:

1. Small sample size due to high dropout rate.
2. Inadequate representation of diverse meditation techniques.
3. Nonavailability of the computer program for stepwise Discriminant Analysis.
4. Lack of computer facilities for running all the variables for statistical analysis.
5. Lack of automatic devices for the integration of EEG data.

SUGGESTIONS FOR FURTHER RESEARCH

1. As diverse attention deployment strategies (cf. Silverman, 1968, 1975) underlie different meditative practices (concentrative versus absorptive; passive versus active; cf. Ornstein and Naranjo, 1974; Goldman, 1977) a larger group of subjects can be divided according to

dichotomous meditative practices and studied for differences in electrocortical activation and concurrent psychophysiological functioning to ascertain the emergence of technique specific patterns (cf. Peper and Ancoli, 1977; alpha/theta and beta as two ends of an EEG continuum of meditation; Pelletier, 1974: occurrence of alpha and theta ASCs). Also within group consonance and uniformity of meditative practices has to be maintained. Also of interest is a comparison with Yoga where no spiritual goal is sought for, and the only aim is mastery over viscer-autonomic functions, as well as a comparison of Yoga with Meditation (Raj Yoga versus Hatha Yoga).

2. The study of the relationship of psychological variables to corresponding hypothesized physiological differences as a consequence of different meditative techniques.
3. A study of the comparisons of the Meditative ASC with other induced ASCs: ASCID (ASC induction device), drugs, hypnosis and alpha feedback.
4. A study of the comparisons between spontaneous and induced ASCs.
5. Comparisons to be made between two psychotic clinical groups who may manifest ASCs: schizophrenics and manic patients, and an investigation of the possible psychobiologic mechanisms underlying these manifestations (cf. Mandell, 1980).

6. Is creativity the clue? A study exploring the creative process in schizophrenics, manics and meditators.
7. Is improved functioning the key to integration or is the answer lying in a subtle balance of electro-cortical, psychophysiological and psychological functioning accompanying the experiential information as essential correlates?
8. A broader survey of the incidence of ASCs in the population.
9. The need to develop a philosophical and theoretical system, in other words the need to develop "state specific sciences" (Tart, 1972).