

A STUDY OF BEHAVIORAL
AND
PSYCHOPHYSIOLOGICAL CORRELATES
IN
CASES SUGGESTIVE OF ALTERED STATES OF
CONSCIOUSNESS

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This is to certify that this work submitted by the candidate as a thesis in fulfilment of the requirement for the Ph.D. degree has not previously formed the basis for award of any degree or diploma to the candidate and this work is a record of the candidate's personal effort.

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DECLARATION

I hereby declare that this research has been conducted by me at the National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, under the guidance of Dr (Ms.) Vinoda N.Murthy, former Professor and Head of the Department of Clinical Psychology, NIMHANS, and at present Professor and Head of the Department of Psychology, Bangalore University, with Dr.C.R.Mukundan, Lecturer in Clinical Psychology, NIMHANS, as the co-guide.

This thesis is being submitted in candidacy for the award of the Ph.D degree in Clinical Psychology of the Bangalore University in the month of August, 1981. This thesis or parts thereof have not been submitted to any other University for any other purpose so far.

Date: 28th Aug: '81

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**A STUDY OF BEHAVIORAL AND PSYCHOPHYSIOLOGICAL
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LIST OF ABBREVIATIONS

| Abbreviation | Meaning |
|--------------|--|
| ANOVA | Analysis of Variance |
| ANS | Autonomic Nervous System |
| APM | Advanced Progressive Matrices |
| ARC | Adjusted Ratio of Clustering |
| ASC | Altered State of Consciousness |
| b-SoC | baseline State of Consciousness |
| BP | Blood Pressure |
| BFV | Blood Pulse Volume |
| BRR | Benson's Relaxation Response |
| CBF | Cerebral Blood Flow |
| CFP | Critical Flicker Fusion |
| CNS | Central Nervous System |
| CNV | Contingent Negative Variation |
| CPZ | Chlorpromazine |
| CRT | Choice Reaction Time |
| d-SoC | discrete State of Consciousness |
| d-ASC | discrete Altered State of Consciousness |
| DPH | diphenylhydantoin |
| ECT | Electro-Convulsive Therapy |
| EDA, EDR | Electrodermal activity, electrodermal response |
| EFT | Embedded Figures Test |
| EEG | Electroencephalogram |
| EKG | Electrocardiogram |
| EMG | Electromyogram |
| E - N | Elaboration - Nonverbal |

| Abbreviation | Meaning |
|--------------|---|
| E - V | Elaboration - Verbal |
| GHQ | General Health Questionnaire |
| GSR | Galvanic Skin Response |
| HR | Heart Rate |
| ICD | International Classification of Diseases |
| LTM | Long term Memory |
| MAP | Muscle Action Potential |
| NIMHANS | National Institute of Mental Health and Neurosciences |
| NT | No Treatment |
| OR | Orienting reflex |
| O - N | Originality - Nonverbal |
| O - V | Originality - Verbal |
| PI | Preparatory Interval |
| PPI | Preceding Preparatory Interval |
| REM | Rapid eye movement |
| RFT | Rod and Frame Test |
| RR | Ratio of Repetition; Respiration Rate |
| RT | Reaction Time |
| R/L | Right/Left |
| SC, SCL, SCR | Skin conductance, Skin conductance level, Skin conductance response |
| SP, SFL | Skin potential, Skin potential level |
| SR, SRL, SRR | Skin resistance, Skin resistance level, Skin resistance response |
| SZ, SZR | Skin impedance, Skin impedance response |
| SF | Spontaneous Fluctuations |

| Abbreviation | Meaning |
|------------------|-------------------------------------|
| S A E | Spiral After Effect |
| SCOR | Skin conductance orienting response |
| SES | Socio-economic status |
| SNS | Sympathetic Nervous System |
| SoC | State of Consciousness |
| SRT | Simple Reaction Time |
| STM | Short Term Memory |
| TFT | Two Flash Threshold |
| TLE | Temporal Lobe Epilepsy |
| TM | Transcendental Meditation |
| TTCT | Torrance Test of Creative Thinking |
| WAIS | Wechsler Adult Intelligence Scale |

ABSTRACT

The present study was undertaken to investigate the behavioral and psychophysiological correlates of states suggestive of altered states of consciousness (ASCs). Briefly, following Hetherington (in Eysenck, 1972) 'behavioral' was used, to characterize total activity of a group and 'psychophysiological' was used as an inclusion term for both central nervous system and autonomic nervous system variables (Fahrenberg, 1972) and the following broad parameters were subsumed under these terms: experiential information, psychological, psychophysiological and electrocortical functioning. If ASCs are viewed as having both adaptive and maladaptive consequences, and are conceptualized as being the pathways mediating either actualization or disintegration, the study aimed to elucidate the possible medical psychological benefits accruing from ASCs, the differentiating characteristics of ASCs, and the possible etiology and relationship of the integrative and maladaptive ASCs.

For this purpose three groups of subjects who had experienced ASCs were selected: practitioners of meditation and other spiritual techniques, schizophrenic patients who at the incipient stage of their illness had experienced the Psychotic ASC, temporal lobe epileptics (TLE) where the ASC constituted a part of the aura. 16 meditators, 15 schizophrenics, 15 epileptics and 15 nonmeditating, nonschizophrenic and nonepileptic normal controls constituted the sample. The experience of ASC in the meditators, schizophrenics and epileptics were established with the aid of experiential criteria. For the Meditative ASC, Ludwig's (1966) and Tart's (1975) experiential criteria, for the Psychotic ASC, Bowers and Freedman's (1966) experiential criteria, and for the Epileptic ASC, Penfield and Jasper's (1954) characteristics of TLE behavior and Bear's (1977) characteristics of interictal TLE behavior were employed to establish the authenticity of the experience. These criteria formed the backbone of the

Information Schedule which also focused on phenomenological information of the ASC and relevant psycho-social information. The Normal group was screened on the General Health Questionnaire (Goldberg, 1972).

The psychophysiological data consisted of the measurement of tonic levels of heart rate, respiration rate, skin resistance level (later converted to skin conductance units), spontaneous fluctuations, muscle tension and blood pulse volume. Electro cortical data was gathered by means of 16-channel EEG recording from 21 scalp electrodes (10-20 Electrode system) using both monopolar and bipolar derivations. The EEG data was subjected to visual analysis and alpha and theta waves were analysed in terms of frequency, amplitude, time percent present and right/left hemispheric activity. The psychological information was obtained from tests such as, reaction time, spiral after-effect, critical flicker fusion used as indicants of cortical arousal, rod and frame test and embedded figures test used to measure field dependence and independence, vigilance task used as a measure of sustained attention, advanced progressive matrices and creativity used as measures of convergent and divergent thinking respectively and index of clustering in recall. Besides, Experiential Information, covering the areas of spiritual and religious training, nature and characteristics of the Meditative ASC (Ludwig, 1966, Tart, 1975), Psychotic ASC (Bowers and Freedman, 1968) and Epileptic ASC (Penfield and Jasper, . 1954; Bear, 1977) as well as the frequency, duration and consequences of ASCs and psycho-social information was collected using the Information Schedule.

The psychophysiological, electro cortical and psychological test information was subjected to ANOVA and to t following F. Correlation Matrices for each group separately were also obtained, and the twenty variables which appeared significant on ANOVA were further analysed using a multivariate technique: Multiple Discriminant Analysis. For the Meditation group, ANOVA was also done for EEG

data obtained in Pre-During and Postmeditation periods.

The results showed the emergence of trends of distinct psychophysiological, electrocortical and psychological functioning for each of the four groups. The Meditation group was characterized by increased cortical activation before meditation, a definite decrement during meditation with the emergence of increased theta activity (both frequency and amplitude) and a sensitization effect which persisted in the postmeditation period. It also had lowered autonomic arousal, dissociation between behavioral and cortical arousal, mobile field differentiation, higher index of clustering, superior vigilance performance, superior performance in both divergent and convergent thinking tasks. The Schizophrenic group showed moderate cortical activation, increased autonomic arousal, tended to be more field independent and were deficient in cognitive functioning as was the TLE group, particularly psychological functioning. The TLE group showed decreased cortical activation, impairment in clustering, attentional deficits, poor performance on measures of both convergent and divergent thinking and increased field dependence. The Normal group showed increased alpha activity, indicating a relaxed state, poor performance on reaction time tasks, greater psychological differentiation, superior performance on measures of convergent and divergent thinking and clustering in recall and the vigilance decrement. The hypotheses of distinct patterns of electrocortical, psychophysiological and psychological functioning was borne out. Regarding the three groups manifesting ASCs there appears to be a definite gradation from the Meditation to the TLE groups, although complex interrelationships among the different variables, which require further probing does not permit a more definite statement about this dimension.

Experiential information showed that the key characteristic common to all ASCs was perceptual distortion which however, had different manifestations.

Significant for the Meditative ASC was the associated component of feelings of rejuvenation while the Psychotic ASC was characterized by changes in the cognitive domain and in emotional expression. The Epileptic ASC was characterized mainly by perceptual illusions and hallucinations.

The Multiple Discriminant Analysis showed five variables which maximally discriminated between the groups. These were conceptual organization, field independence, cortical arousal, creativity and convergent thinking.

The possible mechanisms underlying the integrative and non-integrative consequences of ASCs were explored in terms of temporo-limbic involvement, integration of right and left hemisphere functioning and attentional deficits. The contention of a balance and integration of physiological and psychological functioning underlying the adaptive integrative expression of ASCs was presented and substantiated on the basis of the evidence and data available.