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HIGHER STATES OF CONSCIOUSNESS: EEG COHERENCE, CREATIVITY, AND EXPERIENCES OF THE SIDHIS

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Subjects with the most stabilized transcendental consciousness (the simplest form of awareness) were found to have maximum coherence of brain wave functioning as measured by the EEG, indicating maximum mind-body coordination. This subtlest level of consciousness is a field of all possibilities, correlated with maximum creativity and experiences of the "sidhis" —procedures for producing effects in the body and environment by mere intention of the mind, which result in increased ability to fulfill desires.

EXPERIMENT I

Frontal and central EEG were studied in 22 male participants in an Age of Enlightenment Governor Training Course conducted by Maharishi European Research University in Switzerland. The subjects were selected to represent a wide range of clarity of experience of transcendental consciousness during the Transcendental Meditation technique. Twelve subjects rated themselves as consistently having clear experiences of transcendental consciousness (the "clear group") and ten as having unclear experiences (the "unclear group"). Over the six-month period of the course, all subjects kept daily records of their experiences of the sidhis as described in the *Yoga Sutras* of Patanjali (2), e.g. the ability to know the past and future, knowledge of other minds, the ability to become invisible, "passage through the sky" (reorientation of the physiology and a tendency to levitate), etc. The clear group reported experiencing some degree of the sidhis for a mean of 58 sidhis and the unclear group for a mean of two sidhis.

The degree of progress towards cosmic consciousness or enlightenment* was assessed by subjective reports of the degree to which the continuity of transcendental consciousness was experienced throughout night sleep. Transcendental consciousness, which is at first experienced only during the Transcendental Meditation technique, is, with months or years of practice, experienced throughout the cycle of waking, dreaming, and sleeping, and this is one feature of the state of cosmic consciousness. The unmistakable experience of the onset of cosmic consciousness is the experience of transcendental conscious-

ness during sleep, a phenomenon that has been termed "witnessing sleep."

The EEG from four monopolar electrodes (F3, F4, C3, C4), placed according to the International 10–20 system and referenced to linked ears, was recorded on a Grass Model 78 EEG machine, during a session of the Transcendental Meditation technique. Data were analysed by a Nova 2 computer system with Megatek Laboratory Interface (the methods were essentially the same as those described by Levine et al., paper 20).

Finally, the Torrance Test of Creative Thinking (Verbal, Form A) was administered, scores being obtained for the creativity subscales, viz. fluency, originality, flexibility, and novel uses.

The development of cosmic consciousness indicated by the degree of witnessing of night sleep was found to be positively correlated ($r = .64$, $p < .01$) with the abundance of alpha (8–12 Hz) EEG coherence above the 0.95 threshold (0 = no coherence, 1 = perfect coherence) between the four electrode placements as displayed in the coherence spectral arrays or COSPARS (see figure 1). Witnessing of night sleep was less strongly but significantly correlated with high coherence in the theta (4–8 Hz, $r = .41$) and beta (12–25 Hz, $r = .45$) frequency bands.

In both groups, about 30% of the subjects showed coherence dominance in the bilateral frontal COSPAR,

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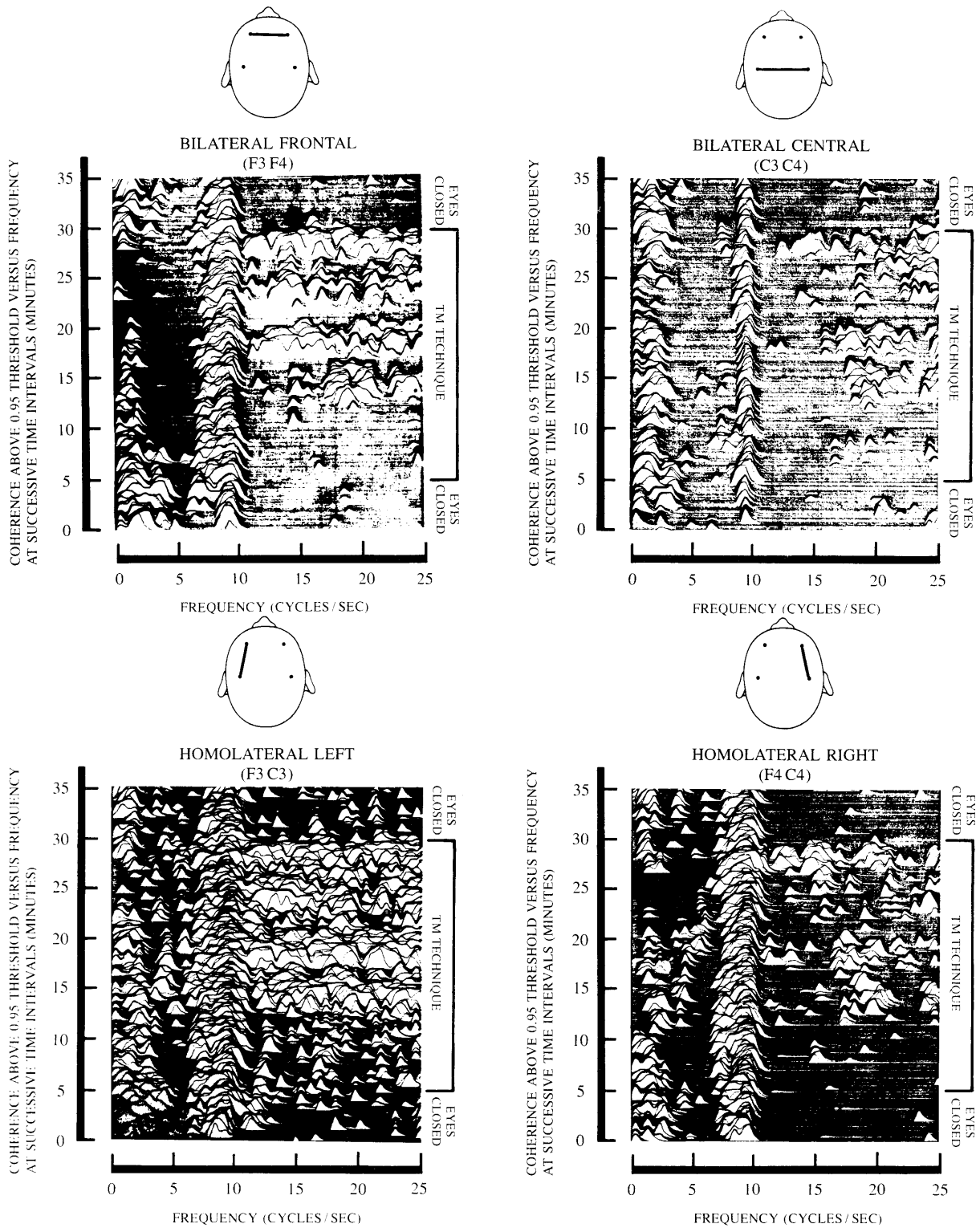


FIG. 1. COHERENCE SPECTRAL ARRAYS (COSPARS) FOR SUBJECT SHOWING STRONG INDICATIONS OF COSMIC CONSCIOUSNESS. The COSPARS display high coherence in excess of a 0.95 threshold as a function of frequency and time. This subject (22 months practicing the Transcendental Meditation technique), who reported frequent experiences of transcendental consciousness throughout night sleep, many experiences of the sidhis, and clear transcending during the Transcendental Meditation technique, was found to have high EEG coherence in all four of the EEG derivations studied (see figure). The subject, who described his subjective state as "bliss," scored 3.5 standard deviations over the mean for graduate students on fluency of creative thought and over 4 standard deviations above the mean on originality. The state of cosmic consciousness, as indicated by witnessing of sleep, is related to higher coherence and high creativity. It is concluded that the practice of the sidhis results in developing cosmic consciousness, which in turn develops the sidhis, the ability to fulfill desires from within oneself.

another 30% in the homolateral left, another 30% in the homolateral right, and about 10% in the bilateral central COSPAR. The clarity of transcendental consciousness experienced during the Transcendental Meditation technique was significantly correlated ($r = .64, p < .01$) with the amount of alpha coherence in the dominant COSPAR. Clear experiences of transcendental consciousness was defined by scores on a 10-point scale ranging from absence of any experience of silent, non-active awareness during the Transcendental Meditation technique to clear experience of pure consciousness during the technique. Clarity of experience of transcendental consciousness was most clearly related to the total amount of coherence in the four brain areas measured.

Subjects who reported frequently experiencing the sidhis were found to have a higher total amount of EEG coherence in the four COSPARS during the Transcendental Meditation technique in the theta ($p = .026$) and alpha ($p = .034$) frequency bands than subjects who infrequently experienced the sidhis (see figure 2).

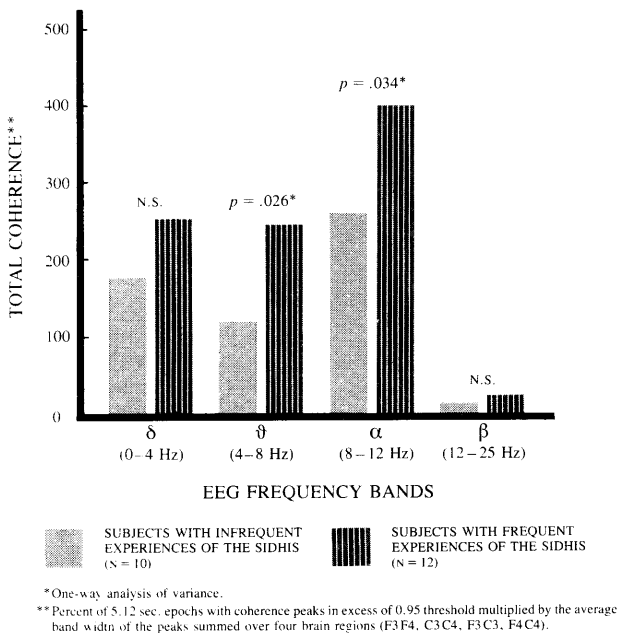


FIG. 2. EXPERIENCES OF THE SIDHIS AND EEG COHERENCE. Subjects with frequent experiences of the sidhis were found to have a greater abundance of high coherence in the theta and alpha frequency bands over the frontal, central, left, and right COSPARS combined.

The amount of above-threshold coherence in the four EEG frequency bands tended to be positively inter-correlated, correlations ranging from .5 to .7, indicating a tendency for high coherence to occur in all frequency bands simultaneously.

Positive correlations were found among total EEG coherence, stabilized pure awareness, number of experiences of sidhis, and subscales of the Torrance Test of Creative Thinking. All of the creativity subscales

(fluency, originality, flexibility, and novel uses) were significantly correlated with the number of experiences of the sidhis (see figure 3). Subjects with the clearest experiences of transcendental consciousness during the Transcendental Meditation technique also reported the

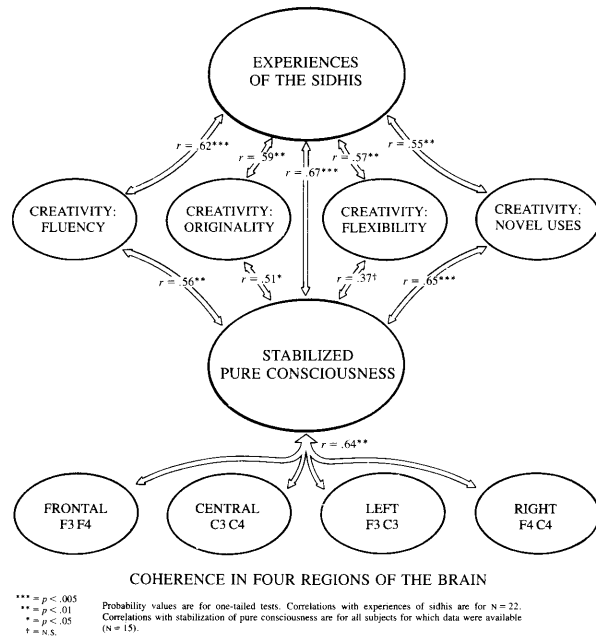


FIG. 3. CORRELATIONS AMONG EEG COHERENCE, STABILIZED PURE CONSCIOUSNESS, CREATIVITY, AND EXPERIENCES OF THE SIDHIS. Significant positive correlations were found between the abundance of alpha EEG coherence in four regions of the brain and stabilized pure awareness (transcendental consciousness) and among stabilized pure awareness, creativity, and frequency of experiences of the sidhis. These results taken together with studies showing longitudinal development of creativity, intelligence, and perception (see paper 104, Orme-Johnson and Granieri), demonstrate the developmental role of the sidhi program.

strongest signs of stabilization of pure consciousness, witnessing of night sleep ($r = .77, p < .001$). Subjects who frequently experienced the sidhis reported clearer experiences of transcending during the Transcendental Meditation technique ($r = .75, p < .001$) and experienced more witnessing of night sleep ($r = .67, p < .01$).

EEG coherence in excess of the 0.95 threshold indicates a difference in frequency from the two electrodes being compared of less than .05 Hz for the 5.12-second epoch length used in this experiment. Thus, coherence above the 0.95 threshold seen in the COSPARS reflects a remarkably precise timing between spatially separated and anatomically distinct regions of the brain. There is experimental evidence that this high degree of linear coupling of the EEG is related to the transfer of information between cerebral systems. Therefore high coherence indicates a state of unobstructed information exchange or "flow of intelligence"—perfect mind-body coordination. The association between high creativity and high coher-

ence found here supports this argument.

The correlation of frequent experiences of the sidhis with high EEG coherence totalled across all of the brain regions studied, and the lack of clear association between the experiences of the sidhis and any particular region of the brain, suggest an extension of Lashley's Mass Action hypotheses (6) to explain the results. In extending Lashley's theory, it is hypothesized that a large amount of coherently interacting cerebral cortex is essential for such experiences to occur. Furthermore, the association of experiences of the sidhis with high coherence across a large proportion of the EEG spectrum suggests that coherence of the total EEG signal, or resonance, may be a necessary factor for the performance of the sidhis to take place. The strong positive correlations among the clarity of experience of pure awareness during the Transcendental Meditation technique, witnessing of night sleep, and experiences of the sidhis indicates two possibilities: 1) that stabilization of pure awareness is a necessary condition for experiencing the sidhis, and 2) that experiences of the sidhis stabilize pure awareness, leading to increased coordination of mind and body, the development of enlightenment.

The high degree of correlation between experiences of the sidhis and ordinary forms of creativity suggests that they share common psychophysiological mechanisms and that the sidhis are only an extension of commonly experienced creative processes, occurring within a framework of more perfect mind-body coordination.

For most efficacious functioning at the mind-body interface, there must be maximum coherence of the entire continuum of electrophysiological and biochemical processes which connects the thought process with all physiological systems.

EXPERIMENT II

In a second study it was found that experiences of the sidhis develop in stages. Course participants were separately interviewed and were found to reach a consensus on the major stages of development of the experiences of several sidhis: Flying, Friendliness, Invisibility, Omniscience, and Strength. For example, the technique for "flying" (2, p. 349) has produced a variety of experiences that range from an awareness of the body becoming permeated by space and in some cases a mental and physical feeling of lightness, to an upward current of energy which may be accompanied by shaking of the body, fast breathing, and a spontaneous forward ballistic motion of

two to three feet or "hop" from the sitting position; to "hopping" with an intense sense of transparency and lightness accompanied by increased control of direction; to more developed experiences such as feeling another upward impulse while still in the air; to a feeling of suspension in the air for a few seconds. An example of "hopping" is the following experience:

"I was sitting on a couch meditating at the time. I felt a tremendous amount of energy go through me and simultaneously I had a vision of my spine and my chest being just white light and a form in the air some place and then my body moved up and down on the couch two or three times. I thought, 'Oh, what is this?' and the next experience I had was hearing my body touch the floor. I say 'hearing' because I didn't feel it until after I heard it. It touched down, very, very softly. There was very little feeling of contact. I moved about a six-foot distance at that time."

It is of interest that these stages correspond to stages of "flying" described in the Shiva Samhita (8, p. 30) of several thousand years of antiquity which states that first the body will shake, then hopping will occur, then the aspirant will "walk on air."

The effect of the technique on friendliness ranges from a feeling of harmony within oneself and/or a greater degree of inner correlation or mind-body coordination; to the above feeling not only encompassing one's self but projecting outward to include objects or people in the vicinity; to an all encompassing friendliness radiating out into the universe, a sense of being an intense beacon light of friendliness filling all creation.

Invisibility has been described as ranging from a tingling sensation and/or a cool feeling in the body; to a feeling that "the energy which is usually being sent out from the body is now falling back into itself" so that "its radiations are collapsing inward"; to a feeling that the body is completely "hiding itself" so that all that is left is the "I-sense"; to becoming a white cloud, subjectively transparent.

Experiences of "omniscience" do not seem to show such a clear developmental sequence. There was general agreement that the early stage could be described as a feeling of expansion of the mind and the expansion of the influence of the body. Four alternatives were given for the next stage:

- a) a sense of universality and the ability to do anything;
- b) a sense of perfection and of being all-pervasive, of being all that there is in nature;
- c) a feeling of being stationed in the borderline between the manifest and the unmanifest levels of creation, a state of ultimate evenness;
- d) an experience of the mind as infinite, radiating

upward in a cone-shaped pattern.

Experiences of “strength” develop from a psychological strength and immovability; to an intense physiological strength where the specific values of the “strength of an elephant” (the phrase used in the sutra) are experienced very concretely in the body; to a sense of the ability to focus strength issuing out of consciousness anywhere, inside or outside the body.

To study the relationship between experiences of the sidhis and EEG coherence, frontal, central, and occipital EEG was measured in the subjects three times each during the following sequence: Transcendental Meditation technique; sanyama* on friendliness, strength, omniscience, invisibility, flying; and the Transcendental Meditation technique. Eight male subjects were recorded individually but while in a group setting and two other subjects, one male and one female, were recorded in an isolated subject room. Heart rate, respiration, and skin resistance were also measured for the latter two subjects.

EEG coherence during the series was measured between seven pairs of monopolar electrodes referenced to the linked ear lobes, F3–F4, C3–C4, O1–O2, F3–C3, F4–C4, C3–O1, C4–O2. The effects of the sanyama varied greatly among subjects. The amount of change in total coherence (all frequencies and derivations) from one sidhi technique to the next were found to be related to the type of experience determined by descriptions on a post-session interview form. Increases in coherence were generally associated with experiences of some specific thought or sensation being transcended, i.e., becoming appreciated at a deeper, more universal level; such as feelings of friendliness expanding to universal love, or sensations of the body turning inward and becoming transparent.

These different experiences have the common characteristic of an individual aspect of awareness (an emotion, a physical sensation, or some aspect of the thought process), transcending to a common universal value. Such experiences and the correlated rise in total coherence are consistent with Maharishi’s emphasis that the purpose of Patanjali’s Yoga Sutras, which literally translated means “threads of unity,” is to structure Unity consciousness, the highest state of enlightenment in which all thoughts, perceptions, and acts are experienced in terms of universal consciousness—“the Self moving within Itself.”

Decreases in EEG coherence were generally correlated with the attention coming outward and sensations of structural purification of the physiology, such as spine-straightening.

Figure 4 shows an example of increased EEG coherence seen on two different days in the COSPARs for a subject

during the flying sidhi. Coherence increased in the right homolateral area (F4–C4) during “flying,” especially in the beta (13–25 Hz) frequency range. A close examination of the raw EEG paper record showed that the coherence increases were not due to artifacts in the EEG. The examples of EEG shown below the COSPARs are from the 10th epoch of “flying” and are completely typical. This subject also showed increased coherence during “flying” in the alpha range in the bilateral central COSPARs (not shown).

Coherence Spectral Arrays

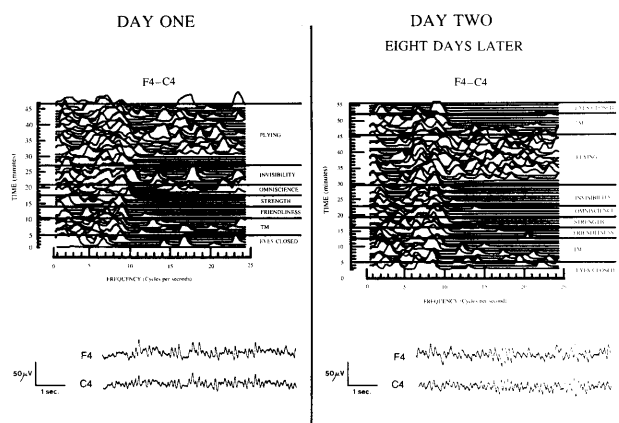


FIG. 4. INCREASED EEG COHERENCE DURING PRACTICE OF THE FLYING SIDHI. Consistent increases in EEG coherence for a subject during practice of the flying sidhi in two different sessions are shown. The coherence spectral arrays are for homolateral right (F4C4) and typical samples of the EEG taken during practice of the flying sidhi shown below each COSPAR indicate that the coherence increases seen during “flying” were not due to artifacts.

Figure 5 shows bilateral frontal coherence (F3–F4) (lower trace) and heart rate (upper trace) during the flying technique for another subject. Generally, coherence and heart rate were negatively correlated, higher coherence corresponding to lower heart rate. However, during the period corresponding to a gradual lift in the air by the subject observed on the TV monitor (during the 10th second of the 9th epoch) coherence rose dramatically and heart rate accelerated from 69 to 96 beats per minute. The ability to maintain a high level of activity together with a high level of integration of brain functioning seen during the sidhis fits precisely with the definition of cosmic consciousness formulated by Maharishi—a high level of integration associated with pure consciousness maintained along with activity.

* Sanyama is the basic technique for performing the sidhis described by Patanjali. It entails the coming together of three elements, *dharana*, focus of attention, *dhyana*, the sequential flow of thought, and *samadhi*, transcendental consciousness or unbounded awareness. The *Yoga Sutras* of Patanjali (2) contains sutras or phrases containing ideas pertaining to specific sidhis upon which sanyama is performed.

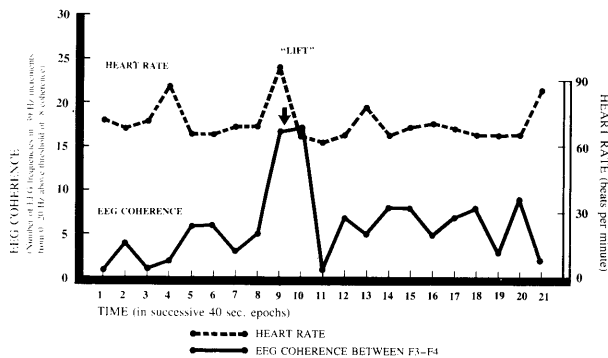


FIG. 5. HIGH EEG COHERENCE AND HEART RATE DURING AN EXPERIENCE OF LEVITATION. The subject in this experiment had a distinct experience of lifting from the ground a small distance during the tenth second of the ninth 40-second epoch of the period of practice of the flying sidhi. It can be seen from the figure above that the "lift" occurred during a period of high bilateral frontal EEG coherence which remained at a high level during the experience. During the time of the "lift" the heart rate accelerated from 69 to 96 beats per minute. It can be seen in the figure that at other times there was generally a negative correlation between heart rate and coherence, lower heart rate corresponding to higher coherence.

Figure 6 shows cycles of coherence in four separate areas of the brain. In this experiment, the subject was asked to press a button after a clear experience of the sidhi. He described his experience as a sequence of 5–15 seconds duration: an abstract experience of pure consciousness, followed by a blissful physical sensation as the sidhi developed, followed by the thought to press the button. Periods of total coherence, during which all areas of the brain were above a coherence level of 0.9, were found to occur in the alpha and/or theta frequency from 5 to 25 seconds before pressing the button in 12 out of 13 button presses. The most frequent time at which the total coherence occurred was at 10 seconds before the button press (80% of the time for theta, 50% of the time for alpha), a time closely corresponding to the subjective experiences of abstract pure consciousness. Frequently, total coherence occurred simultaneously in both alpha and theta frequencies (see figure above). Periods of total coherence were also found to precede "hopping" in this subject.

These periods of total coherence, as during omniscience in figure 6, were found to correspond to slower respiration and stability of skin resistance, reinforcing the impression that they represent the state of least excitation of the nervous system. Periods of lower coherence were correlated with physiological activation—skin resistance responses and occasionally variability of respiration. These data, taken together with the correlation between total coherence and stabilization of transcendental consciousness (witnessing) found in experiment one, and considered together with the increases in EEG coherence

found to occur specifically during Transcendental Meditation by Levine (paper 20) and high levels of EEG coherence found during respiratory suspension and clear experiences of transcendental consciousness found by Farrow (paper 7), strongly indicate that the EEG signature of transcendental consciousness is total spatial coherence, possibly simultaneously in all frequencies of the EEG spectrum.

The coherence cycles data (Figure 6) suggest that a fruitful approach to discovering the EEG signature of each sidhi is in how the brain goes into and comes out of total coherence. Another possibility is that when the sidhis become fully developed coherence will be maintained throughout the performance, as in the lift occurring during a period of elevated coherence seen in Figure 5.

INTERPRETATION OF COHERENCE AS THE BASIS OF SIDHI PERFORMANCE—Several authors have presented evidence that the coupling pattern among various neuro-anatomical regions define the functional structure of the brain (e.g. 1, 5, 7). Focus of attention appears to organize neural processes into coherently interacting patterns. The mechanism for this may be the thalamic scanning of the cortex that Elul (4) has suggested or through selective filtering by cortical neural networks of subcortical inputs as Da Silva, van Lierop, Schrijer, and van Leeuwen (3) have suggested.

Whereas ordinary attentional processes appear to produce high coherence in localized areas of the brain, it is proposed that the high levels of total cortico-cortical coherence in all areas associated with transcendental consciousness represents delocalized attention or unbounded awareness.

The functional significance of developing unbounded awareness and total coherence during the Transcendental Meditation technique is seen from the results of longitudinal studies showing increased field independence, intelligence, creativity, and behavioral flexibility (see paper 103). Total coherence appears to represent a state of pure potentiality from which coupling of any or all cortical areas available for the processing of information results in higher levels of performance in activity, such as greater intelligence, creativity, and perceptual differentiation.

Inasmuch as the flow of information between coherently interacting cerebral systems represents the flow of intelligence that precedes interaction between intention and physical response, high total coherence would indicate a high level of mind-body coordination.

CONCLUSION

These experiments begin to indicate the mechanics whereby thought first mobilizes the body and then the

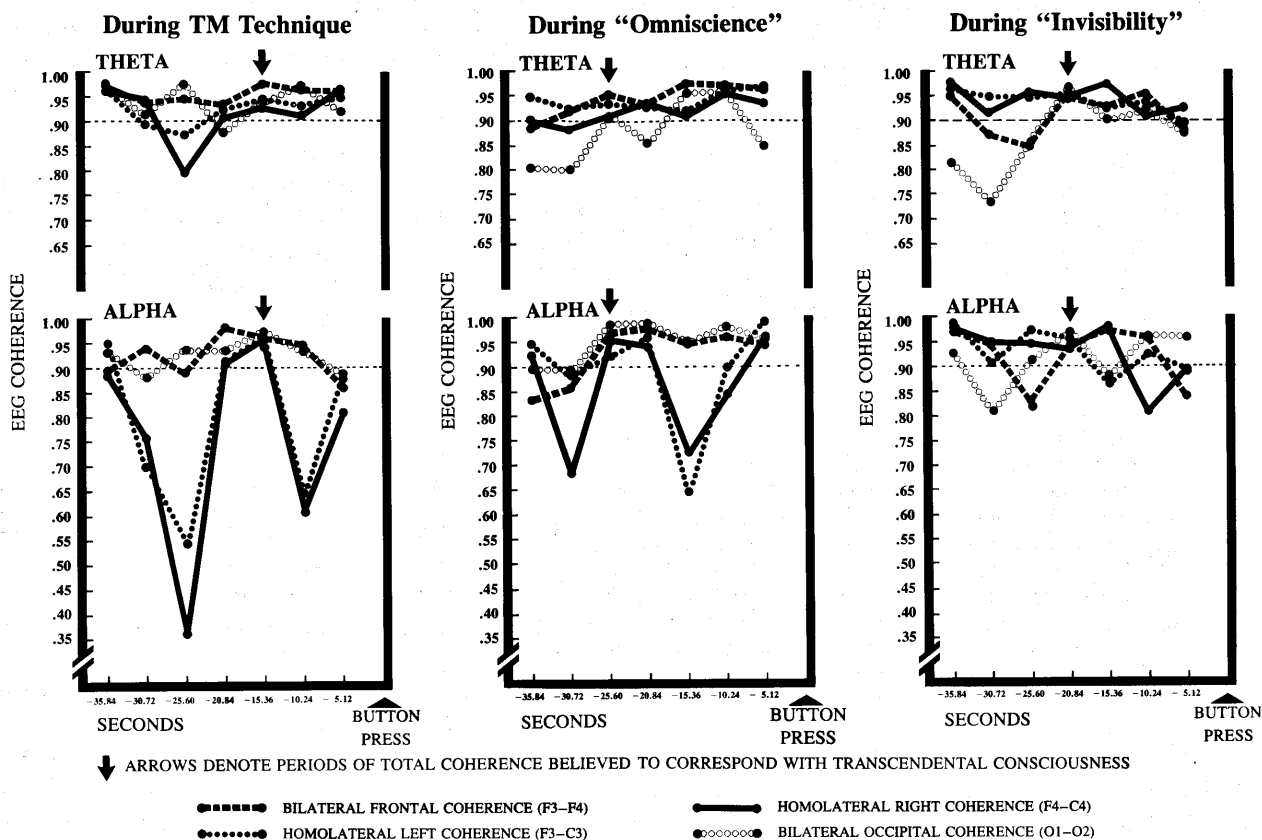


FIG. 6. CYCLIC BEHAVIOR OF EEG COHERENCE DURING PRACTICE OF THE SIDHIS. In order to obtain a close estimate of the relationship between coherence changes and subjective experiences, a subject was asked to press a button after a clear experience of each sidhi. The order of techniques was (a) several minutes of the Transcendental Meditation technique, (b) the sidhis on profound friendliness, supernormal strength, omniscience, invisibility, flying, and (c) the TM technique. The subject described the sequence of experiences that commonly prompted the button pushes as a cycle: first an abstract experience of pure consciousness, then five to ten seconds of some physical experience of great pleasure associated with the experiences of the sidhis (the subject reported that "the stirring of abstract pure consciousness brings bliss which was more of a physical sensation"), then the thought to press the button.

Twelve out of the thirteen button presses were preceded by coherence in excess of 0.9 simultaneously in all brain areas in the alpha and/or theta frequencies (on a scale of 0 to 1.0). Total coherence (high coherence in all areas) occurred 10 seconds before pressing the button 80% of the time for theta and 50% of the time for alpha. At other times it occurred from 5 to 25 seconds before pressing the button. Periods of total coherence were correlated with slow respiration and stable skin resistance. Periods of lower coherence were correlated with physiological activation—skin resistance responses and occasionally variability in the respiration.

environment for fulfilling desires. The ability to fulfill desires depends upon mind-body coordination which ultimately is extended to coordination of the mind and the environment.

The appearance of spreading areas of EEG coherence during performance of sidhis is entirely analogous to the neurophysiological principle of recruitment, whereby more and more individual elements are brought into simultaneous action to accomplish more and more difficult tasks—more and more laws of nature are spontaneously recruited to fulfill the desire without resistance. (This is an example of an endogenous process described in Rig Veda whereby more and more forces of nature are recruited to accomplish an intention from the mind-body interface.)

The fundamental organizing principle of the nervous

system, the reflex (Sherrington, 1906), seems to also underlie the phenomena of the sidhis. Characteristic inputs result in stereotyped outputs. Whereas in a reflex an excitation of a stretch receptor results in muscular activation, in the sidhis, simple activation stimuli with equal reliability evoke well-defined response categories. Whereas in the reflex the central excitatory state of the nervous system modulates the probability of reflex outcome, similarly in the case of sidhis, a basal state, namely transcendental consciousness, is the substratum from which the activity emerges. Patanjali's Yoga Sutras contain formulae which specify the relationships between specific inputs into consciousness and their outputs in terms of sidhi performance. The sidhis may be considered to operate within the same framework as modern ethology, which describes how a particular signed stimulus reliably and reproducibly evokes a highly

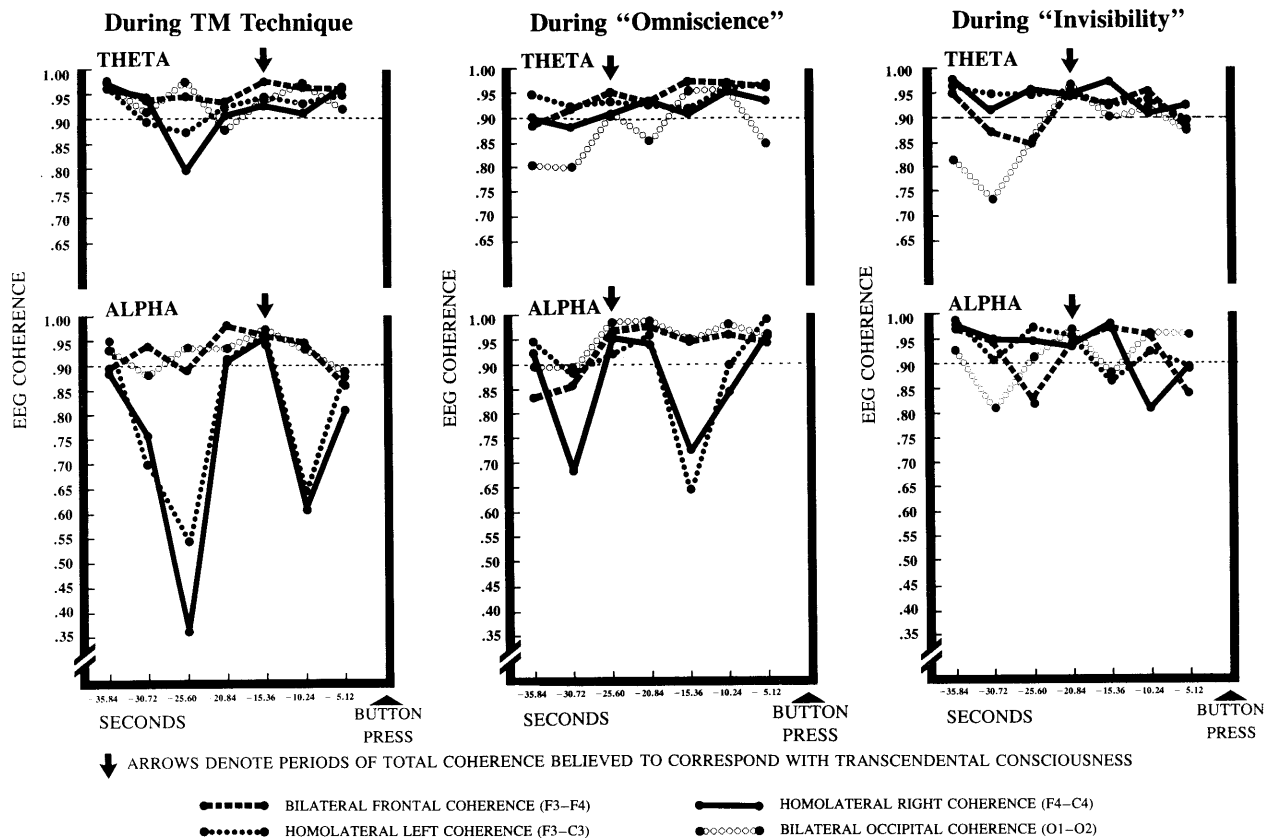


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specific unit of behavior to produce a desired effect. Thus, the formulae of Patanjali may be regarded as sign stimuli specifically designed to elicit from a coherent human nervous system desired effects, however unusual these desired effects may be.

At the level of neuronal mechanisms certain other parallels are obvious. First of all sidhi performance must involve the spontaneous read-out of pre-programmed neuronal information instead of the *de novo* fabrication of specific pathways; the unfoldment of latent potential. Secondly, with each use, the central program is more stabilized as with facilitated synapses. This is consistent with the notion that the sidhis are species-specific traits encoded in any member of the species and capable of expression as a phenotype. The sidhis are part of the genetic endowment of all mankind.

The genes should be regarded as analogous to architectural plans to a castle of all possibilities. The process of sanyama is the key to the doors of certain chambers of human potential. Pure consciousness is the corridor and the different sutras of Patanjali are the keys to open the doors of the chambers which house all possible human capabilities. Transcendental Meditation is the vacuum cleaner which clears the debris from the corridor and allows exploration of the entire range of creative intelligence open to man. Performance of the sidhis simply restores to man the range of abilities with which he is naturally endowed.

Creativity performed in the least excited level of awareness, described by Patanjali as sanyama, is reminiscent of the Goldstone Boson process in Quantum Field theory whereby the creation of an elementary particle takes place even with an infinitesimal excitation of the vacuum. The parallel between the quantum field theory of effortless creation and Maharishi's theory of sanyama continues in that both involve spontaneous *symmetry breaking*. The creation of a Goldstone Boson takes place in a quantum field wherever the influences involved are such as to produce a spontaneous change from a more homogenous to a less homogenous state. In the regime of consciousness the influence of the Patanjali sutra on the wholeness of pure consciousness is such as to cause a spontaneous localization of the pure consciousness in the direction of the particular result specified by Patanjali, that is, a symmetry breaking of the consciousness takes place whereby the wholeness of consciousness flows into a particular localization. This process enlivens and stabilizes wholeness of conscious awareness within one's self and at the same time produces the sidhi phenomena.

Thus, the process of creativity is self-regenerating—the more you create, the more creative you become, simply because the actual mechanics of creation has the effect of stabilizing its own basis in pure consciousness.

Total coherence in the cortex represents an undifferentiated state in which an infinite variety of local cortical domains of coherence can be formed, producing the specific variety of sidhi performances recorded by Patanjali, at the same time strengthening the integrity of cortical coherence. Strengthened coherence indicates strengthening of the neuronal components and their interactions.

It may be remarked that the specific sequence of the sidhi practices recommended by Patanjali is designed collectively to stabilize and strengthen all possible neuronal networks lying at the basis of each type of motor and sensory performance and each area of mind-body coordination, enlivening the total potential of the thought process—making thought powerful at its source.

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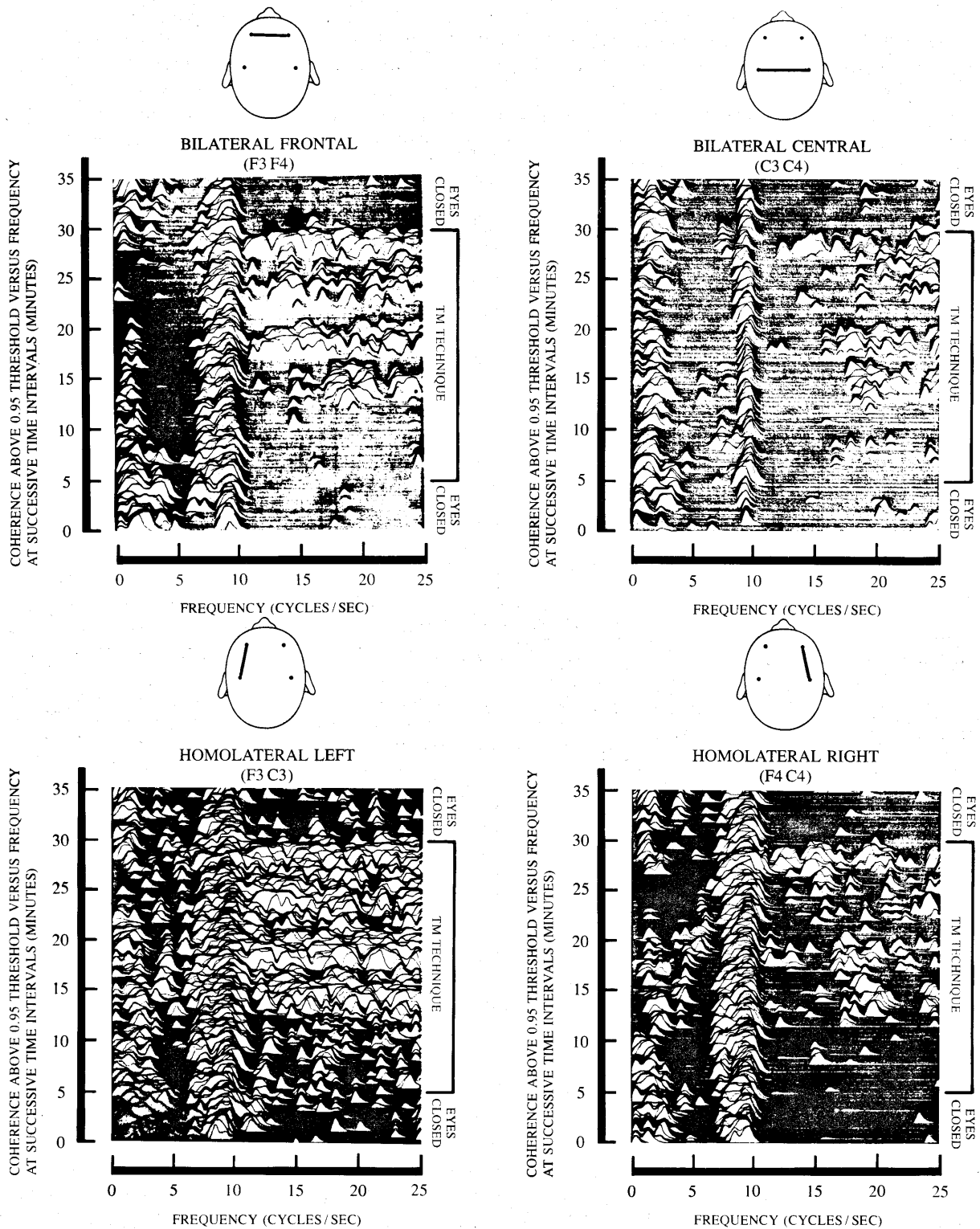


FIG. 1. COHERENCE SPECTRAL ARRAYS (COSPARS) FOR SUBJECT SHOWING STRONG INDICATIONS OF COSMIC CONSCIOUSNESS. The COSPARS display high coherence in excess of a 0.95 threshold as a function of frequency and time. This subject (22 months practicing the Transcendental Meditation technique), who reported frequent experiences of transcendental consciousness throughout night sleep, many experiences of the sidhis, and clear transcending during the Transcendental Meditation technique, was found to have high EEG coherence in all four of the EEG derivations studied (see figure). The subject, who described his subjective state as "bliss," scored 3.5 standard deviations over the mean for graduate students on fluency of creative thought and over 4 standard deviations above the mean on originality. The state of cosmic consciousness, as indicated by witnessing of sleep, is related to higher coherence and high creativity. It is concluded that the practice of the sidhis results in developing cosmic consciousness, which in turn develops the sidhis, the ability to fulfill desires from within oneself.

another 30% in the homolateral left, another 30% in the homolateral right, and about 10% in the bilateral central COSPAR. The clarity of transcendental consciousness experienced during the Transcendental Meditation technique was significantly correlated ($r = .64, p < .01$) with the amount of alpha coherence in the dominant COSPAR. Clear experiences of transcendental consciousness was defined by scores on a 10-point scale ranging from absence of any experience of silent, non-active awareness during the Transcendental Meditation technique to clear experience of pure consciousness during the technique. Clarity of experience of transcendental consciousness was most clearly related to the total amount of coherence in the four brain areas measured.

Subjects who reported frequently experiencing the sidhis were found to have a higher total amount of EEG coherence in the four COSPARS during the Transcendental Meditation technique in the theta ($p = .026$) and alpha ($p = .034$) frequency bands than subjects who infrequently experienced the sidhis (see figure 2).

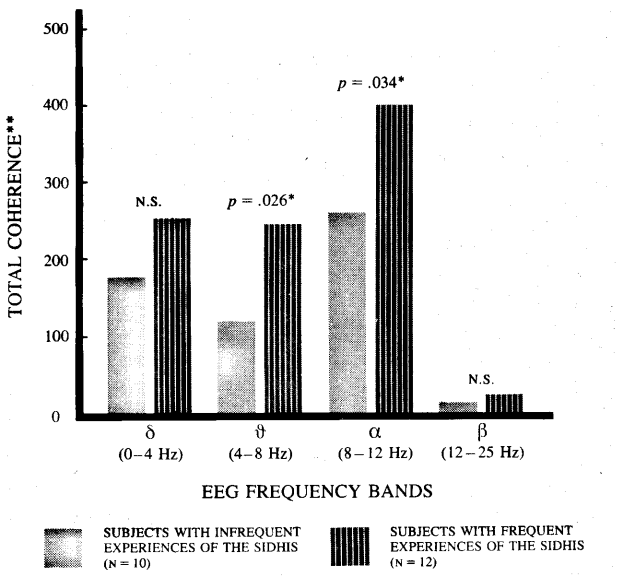


FIG. 2. EXPERIENCES OF THE SIDHIS AND EEG COHERENCE. Subjects with frequent experiences of the sidhis were found to have a greater abundance of high coherence in the theta and alpha frequency bands over the frontal, central, left, and right COSPARS combined.

The amount of above-threshold coherence in the four EEG frequency bands tended to be positively inter-correlated, correlations ranging from .5 to .7, indicating a tendency for high coherence to occur in all frequency bands simultaneously.

Positive correlations were found among total EEG coherence, stabilized pure awareness, number of experiences of sidhis, and subscales of the Torrance Test of Creative Thinking. All of the creativity subscales

(fluency, originality, flexibility, and novel uses) were significantly correlated with the number of experiences of the sidhis (see figure 3). Subjects with the clearest experiences of transcendental consciousness during the Transcendental Meditation technique also reported the

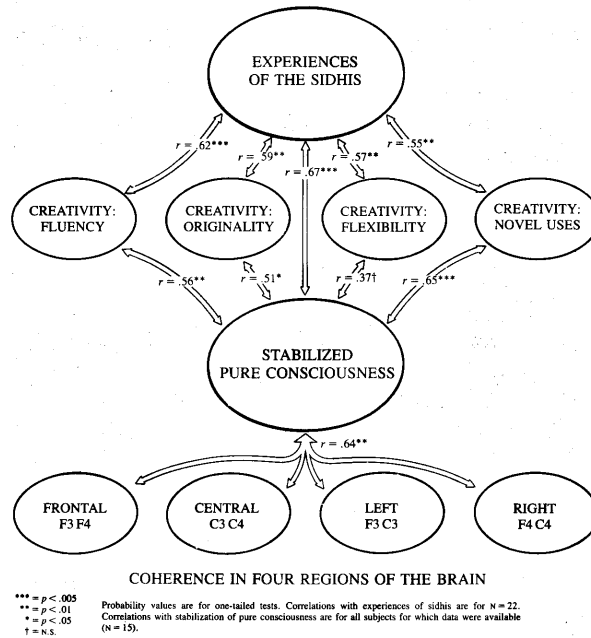


FIG. 3. CORRELATIONS AMONG EEG COHERENCE, STABILIZED PURE CONSCIOUSNESS, CREATIVITY, AND EXPERIENCES OF THE SIDHIS. Significant positive correlations were found between the abundance of alpha EEG coherence in four regions of the brain and stabilized pure awareness (transcendental consciousness) and among stabilized pure awareness, creativity, and frequency of experiences of the sidhis. These results taken together with studies showing longitudinal development of creativity, intelligence, and perception (see paper 104, Orme-Johnson and Granieri), demonstrate the developmental role of the sidhi program.

strongest signs of stabilization of pure consciousness, witnessing of night sleep ($r = .77, p < .001$). Subjects who frequently experienced the sidhis reported clearer experiences of transcending during the Transcendental Meditation technique ($r = .75, p < .001$) and experienced more witnessing of night sleep ($r = .67, p < .01$).

EEG coherence in excess of the 0.95 threshold indicates a difference in frequency from the two electrodes being compared of less than .05 Hz for the 5.12-second epoch length used in this experiment. Thus, coherence above the 0.95 threshold seen in the COSPARS reflects a remarkably precise timing between spatially separated and anatomically distinct regions of the brain. There is experimental evidence that this high degree of linear coupling of the EEG is related to the transfer of information between cerebral systems. Therefore high coherence indicates a state of unobstructed information exchange or "flow of intelligence"—perfect mind-body coordination. The association between high creativity and high coher-

ence found here supports this argument.

The correlation of frequent experiences of the sidhis with high EEG coherence totalled across all of the brain regions studied, and the lack of clear association between the experiences of the sidhis and any particular region of the brain, suggest an extension of Lashley's Mass Action hypotheses (6) to explain the results. In extending Lashley's theory, it is hypothesized that a large amount of coherently interacting cerebral cortex is essential for such experiences to occur. Furthermore, the association of experiences of the sidhis with high coherence across a large proportion of the EEG spectrum suggests that coherence of the total EEG signal, or resonance, may be a necessary factor for the performance of the sidhis to take place. The strong positive correlations among the clarity of experience of pure awareness during the Transcendental Meditation technique, witnessing of night sleep, and experiences of the sidhis indicates two possibilities: 1) that stabilization of pure awareness is a necessary condition for experiencing the sidhis, and 2) that experiences of the sidhis stabilize pure awareness, leading to increased coordination of mind and body, the development of enlightenment.

The high degree of correlation between experiences of the sidhis and ordinary forms of creativity suggests that they share common psychophysiological mechanisms and that the sidhis are only an extension of commonly experienced creative processes, occurring within a framework of more perfect mind-body coordination.

For most efficacious functioning at the mind-body interface, there must be maximum coherence of the entire continuum of electrophysiological and biochemical processes which connects the thought process with all physiological systems.

EXPERIMENT II

In a second study it was found that experiences of the sidhis develop in stages. Course participants were separately interviewed and were found to reach a consensus on the major stages of development of the experiences of several sidhis: Flying, Friendliness, Invisibility, Omniscience, and Strength. For example, the technique for "flying" (2, p. 349) has produced a variety of experiences that range from an awareness of the body becoming permeated by space and in some cases a mental and physical feeling of lightness, to an upward current of energy which may be accompanied by shaking of the body, fast breathing, and a spontaneous forward ballistic motion of

two to three feet or "hop" from the sitting position; to "hopping" with an intense sense of transparency and lightness accompanied by increased control of direction; to more developed experiences such as feeling another upward impulse while still in the air; to a feeling of suspension in the air for a few seconds. An example of "hopping" is the following experience:

"I was sitting on a couch meditating at the time. I felt a tremendous amount of energy go through me and simultaneously I had a vision of my spine and my chest being just white light and a form in the air some place and then my body moved up and down on the couch two or three times. I thought, 'Oh, what is this?' and the next experience I had was hearing my body touch the floor. I say 'hearing' because I didn't feel it until after I heard it. It touched down, very, very softly. There was very little feeling of contact. I moved about a six-foot distance at that time."

It is of interest that these stages correspond to stages of "flying" described in the Shiva Samhita (8, p. 30) of several thousand years of antiquity which states that first the body will shake, then hopping will occur, then the aspirant will "walk on air."

The effect of the technique on friendliness ranges from a feeling of harmony within oneself and/or a greater degree of inner correlation or mind-body coordination; to the above feeling not only encompassing one's self but projecting outward to include objects or people in the vicinity; to an all encompassing friendliness radiating out into the universe, a sense of being an intense beacon light of friendliness filling all creation.

Invisibility has been described as ranging from a tingling sensation and/or a cool feeling in the body; to a feeling that "the energy which is usually being sent out from the body is now falling back into itself" so that "its radiations are collapsing inward"; to a feeling that the body is completely "hiding itself" so that all that is left is the "I-sense"; to becoming a white cloud, subjectively transparent.

Experiences of "omniscience" do not seem to show such a clear developmental sequence. There was general agreement that the early stage could be described as a feeling of expansion of the mind and the expansion of the influence of the body. Four alternatives were given for the next stage:

- a) a sense of universality and the ability to do anything;
- b) a sense of perfection and of being all-pervasive, of being all that there is in nature;
- c) a feeling of being stationed in the borderline between the manifest and the unmanifest levels of creation, a state of ultimate evenness;
- d) an experience of the mind as infinite, radiating

upward in a cone-shaped pattern.

Experiences of “strength” develop from a psychological strength and immovability; to an intense physiological strength where the specific values of the “strength of an elephant” (the phrase used in the sutra) are experienced very concretely in the body; to a sense of the ability to focus strength issuing out of consciousness anywhere, inside or outside the body.

To study the relationship between experiences of the sidhis and EEG coherence, frontal, central, and occipital EEG was measured in the subjects three times each during the following sequence: Transcendental Meditation technique; sanyama* on friendliness, strength, omniscience, invisibility, flying; and the Transcendental Meditation technique. Eight male subjects were recorded individually but while in a group setting and two other subjects, one male and one female, were recorded in an isolated subject room. Heart rate, respiration, and skin resistance were also measured for the latter two subjects.

EEG coherence during the series was measured between seven pairs of monopolar electrodes referenced to the linked ear lobes, F3–F4, C3–C4, O1–O2, F3–C3, F4–C4, C3–O1, C4–O2. The effects of the sanyama varied greatly among subjects. The amount of change in total coherence (all frequencies and derivations) from one sidhi technique to the next were found to be related to the type of experience determined by descriptions on a post-session interview form. Increases in coherence were generally associated with experiences of some specific thought or sensation being transcended, i.e., becoming appreciated at a deeper, more universal level; such as feelings of friendliness expanding to universal love, or sensations of the body turning inward and becoming transparent.

These different experiences have the common characteristic of an individual aspect of awareness (an emotion, a physical sensation, or some aspect of the thought process), transcending to a common universal value. Such experiences and the correlated rise in total coherence are consistent with Maharishi’s emphasis that the purpose of Patanjali’s Yoga Sutras, which literally translated means “threads of unity,” is to structure Unity consciousness, the highest state of enlightenment in which all thoughts, perceptions, and acts are experienced in terms of universal consciousness—“the Self moving within Itself.”

Decreases in EEG coherence were generally correlated with the attention coming outward and sensations of structural purification of the physiology, such as spine-straightening.

Figure 4 shows an example of increased EEG coherence seen on two different days in the COSPARs for a subject

during the flying sidhi. Coherence increased in the right homolateral area (F4–C4) during “flying,” especially in the beta (13–25 Hz) frequency range. A close examination of the raw EEG paper record showed that the coherence increases were not due to artifacts in the EEG. The examples of EEG shown below the COSPARs are from the 10th epoch of “flying” and are completely typical. This subject also showed increased coherence during “flying” in the alpha range in the bilateral central COSPARs (not shown).

Coherence Spectral Arrays

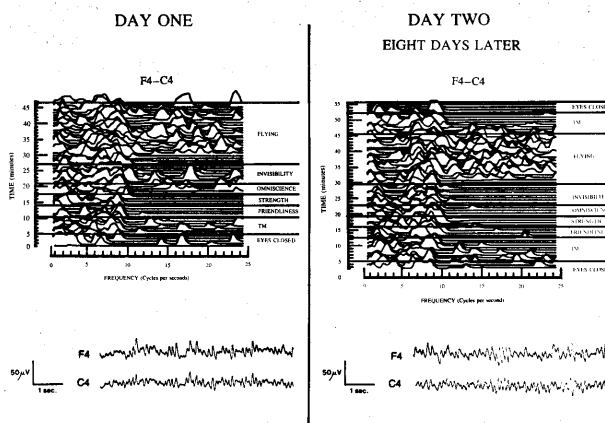


FIG. 4. INCREASED EEG COHERENCE DURING PRACTICE OF THE FLYING SIDHI. Consistent increases in EEG coherence for a subject during practice of the flying sidhi in two different sessions are shown. The coherence spectral arrays are for homolateral right (F4C4) and typical samples of the EEG taken during practice of the flying sidhi shown below each COSPAR indicate that the coherence increases seen during “flying” were not due to artifacts.

Figure 5 shows bilateral frontal coherence (F3–F4) (lower trace) and heart rate (upper trace) during the flying technique for another subject. Generally, coherence and heart rate were negatively correlated, higher coherence corresponding to lower heart rate. However, during the period corresponding to a gradual lift in the air by the subject observed on the TV monitor (during the 10th second of the 9th epoch) coherence rose dramatically and heart rate accelerated from 69 to 96 beats per minute. The ability to maintain a high level of activity together with a high level of integration of brain functioning seen during the sidhis fits precisely with the definition of cosmic consciousness formulated by Maharishi—a high level of integration associated with pure consciousness maintained along with activity.

* Sanyama is the basic technique for performing the sidhis described by Patanjali. It entails the coming together of three elements, *dharana*, focus of attention, *dhyana*, the sequential flow of thought, and *samadhi*, transcendental consciousness or unbounded awareness. The *Yoga Sutras* of Patanjali (2) contains sutras or phrases containing ideas pertaining to specific sidhis upon which sanyama is performed.

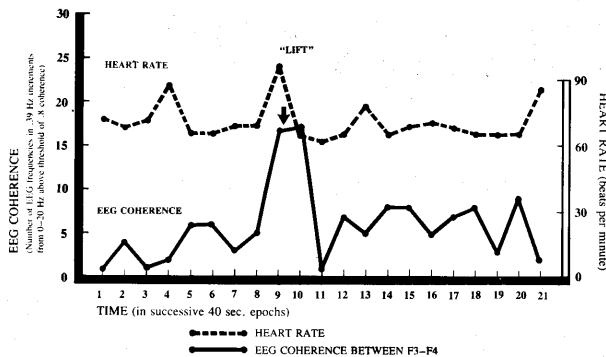


FIG. 5. HIGH EEG COHERENCE AND HEART RATE DURING AN EXPERIENCE OF LEVITATION. The subject in this experiment had a distinct experience of lifting from the ground a small distance during the tenth second of the ninth 40-second epoch of the period of practice of the flying sidhi. It can be seen from the figure above that the "lift" occurred during a period of high bilateral frontal EEG coherence which remained at a high level during the experience. During the time of the "lift" the heart rate accelerated from 69 to 96 beats per minute. It can be seen in the figure that at other times there was generally a negative correlation between heart rate and coherence, lower heart rate corresponding to higher coherence.

Figure 6 shows cycles of coherence in four separate areas of the brain. In this experiment, the subject was asked to press a button after a clear experience of the sidhi. He described his experience as a sequence of 5–15 seconds duration: an abstract experience of pure consciousness, followed by a blissful physical sensation as the sidhi developed, followed by the thought to press the button. Periods of total coherence, during which all areas of the brain were above a coherence level of 0.9, were found to occur in the alpha and/or theta frequency from 5 to 25 seconds before pressing the button in 12 out of 13 button presses. The most frequent time at which the total coherence occurred was at 10 seconds before the button press (80% of the time for theta, 50% of the time for alpha), a time closely corresponding to the subjective experiences of abstract pure consciousness. Frequently, total coherence occurred simultaneously in both alpha and theta frequencies (see figure above). Periods of total coherence were also found to precede "hopping" in this subject.

These periods of total coherence, as during omniscience in figure 6, were found to correspond to slower respiration and stability of skin resistance, reinforcing the impression that they represent the state of least excitation of the nervous system. Periods of lower coherence were correlated with physiological activation—skin resistance responses and occasionally variability of respiration. These data, taken together with the correlation between total coherence and stabilization of transcendental consciousness (witnessing) found in experiment one, and considered together with the increases in EEG coherence

found to occur specifically during Transcendental Meditation by Levine (paper 20) and high levels of EEG coherence found during respiratory suspension and clear experiences of transcendental consciousness found by Farrow (paper 7), strongly indicate that the EEG signature of transcendental consciousness is total spatial coherence, possibly simultaneously in all frequencies of the EEG spectrum.

The coherence cycles data (Figure 6) suggest that a fruitful approach to discovering the EEG signature of each sidhi is in how the brain goes into and comes out of total coherence. Another possibility is that when the sidhi become fully developed coherence will be maintained throughout the performance, as in the lift occurring during a period of elevated coherence seen in Figure 5.

INTERPRETATION OF COHERENCE AS THE BASIS OF SIDHI PERFORMANCE—Several authors have presented evidence that the coupling pattern among various neuro-anatomical regions define the functional structure of the brain (e.g. 1, 5, 7). Focus of attention appears to organize neural processes into coherently interacting patterns. The mechanism for this may be the thalamic scanning of the cortex that Elul (4) has suggested or through selective filtering by cortical neural networks of subcortical inputs as Da Silva, van Lierop, Schrijer, and van Leeuwen (3) have suggested.

Whereas ordinary attentional processes appear to produce high coherence in localized areas of the brain, it is proposed that the high levels of total cortico-cortical coherence in all areas associated with transcendental consciousness represents delocalized attention or unbounded awareness.

The functional significance of developing unbounded awareness and total coherence during the Transcendental Meditation technique is seen from the results of longitudinal studies showing increased field independence, intelligence, creativity, and behavioral flexibility (see paper 103). Total coherence appears to represent a state of pure potentiality from which coupling of any or all cortical areas available for the processing of information results in higher levels of performance in activity, such as greater intelligence, creativity, and perceptual differentiation.

Inasmuch as the flow of information between coherently interacting cerebral systems represents the flow of intelligence that precedes interaction between intention and physical response, high total coherence would indicate a high level of mind-body coordination.

CONCLUSION

These experiments begin to indicate the mechanics whereby thought first mobilizes the body and then the

specific unit of behavior to produce a desired effect. Thus, the formulae of Patanjali may be regarded as sign stimuli specifically designed to elicit from a coherent human nervous system desired effects, however unusual these desired effects may be.

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