Brainwaves, Total Brain Functioning, and the Development of Higher States of Consciousness: A Tutorial

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Summary: The 100 billion human brain cells function in a 'sea' of electrical activity that can be detected by sensors placed on the scalp. Neuroscience considers brain cells which give off electrical signals in step with each other to be correlated or "coherent." Coherent waves of electrical activity in the brain represent a key sign of integrated or coordinated functioning in a brain which performs millions of separate tasks every second. The synchronous activity arising from millions of brain cells is constantly fluctuating. This endogenous oscillation is thought to represent the ongoing neural processing corresponding to the structure and content of our changing mental states. These endogenous rhythms periodically summate, allowing the electrical activity to reach the surface of the scalp where it can then be recorded as brainwaves. Sensory experience represents a dynamic manipulation and phase resetting of the endogenous oscillations of the circuits within and between the thalamus and cerebral cortex. Integration of the vast diversity of brain activity supports our states of consciousness and the content of our conscious experience. The Transcendental Meditation technique, the TM-Sidhi program and Yogic Flying have been shown to greatly enhance brain integration. The progressive growth of global brain coherence closely correlates with the growth of human potential and well-being, reaching a state of total brain functioning in enlightenment.

Section 1: Brainwave Short Tutorial

Part 1: Brain Electrical Activity—How Brainwaves are Created

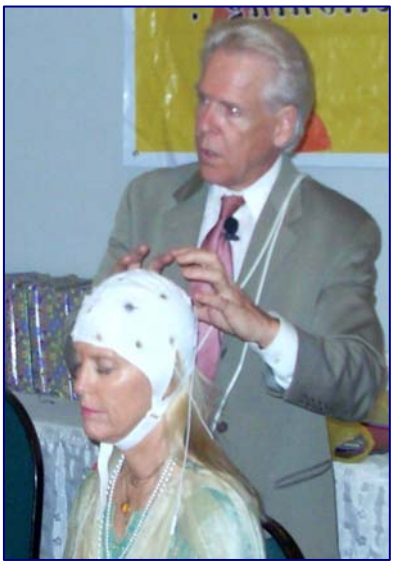
Summary: Brainwaves represent the collected activity of millions of brain cells interacting through electrical and chemical messaging systems. When brain cells work together in a more correlated manner, the brain waves become enhanced in size.

- Brain cells—actually all cells—are like little batteries. They constantly produce an electric charge to perform different functions. Unlike batteries, the electric charge created by the brain cell membranes is not constant, fluctuating continuously.
- The continuous fluctuations of electrical voltage on the surface of brain cells are like tiny, tiny ripples on the surface of a pond.
- Brain cells are link together in complex arrays. From time to time and for varying duration, brain cells become active together functioning as an integrated assembly of neural cells.
- These electrical fluctuations set up electrical currents within the space between cells that can travel and spread for some distance.
- The correlated fluctuations of many individual brain cells add up to create higher levels or amplitudes of fluctuating electrical currents—as if many tiny pebbles tossed into a pond at the same moment, at the same spot, create higher waves on the surface. Thus, correlated electrical activity gives rise to bigger electrical currents.
- When the fluctuations are added together, the enhanced height or amplitude of electrical activity reaches the surface of the brain and passes through the skull to be detected as very faint fluctuating electrical signals called brainwaves.

Part 2: The Electroencephalograph (EEG)— Measuring Brainwaves

Summary: The EEG is able to detect very faint electrical signals on the surface of the head reflecting neural activity in the cortex below. Different frequencies of oscillating waves are considered to represent different modes of brain and cognitive function.

- The Electroencephalograph machine (EEG; electro=electric; encephalo=brain; graph=patterns) is the standard tool to detect these extremely weak fluctuations and then amplify them for display and for detailed analysis.
- The EEG scalp sensors or electrodes detect fluctuations from a relatively large (several centimeters in diameter) area of the brain surface and therefore detect the fluctuating activity of millions of cortical brain cells. EEG can employ between 2 to 200 sensors on the scalp. A widely used system (Biosemi) has 32 sensors and is shown below.



Another system we use is the Nexus-10 and Nexus-32 (www.MindMedia.nl). Examples of the EEG will be shown below from both systems.

- EEG has known artifacts including eye movements and muscle movement, both of which produce large electrical fluctuations. These need to be minimized during acquisition and removed from the data collected.
- Brain cells fluctuate in their activity at different rates (frequencies)—slow, medium and fast. Additional summaries give more detail about the different rhythms.
- Each frequency has been correlated with a different style of brain functioning. The graph below shows five main frequencies: Delta, Theta, Alpha, Beta and Gamma.
- Gamma activity (25-60 Hz and higher) are being extensively studied for its role in binding together diverse neural activity to create perceptual content or representations in our awareness—predominantly object-referral processes.
- Alpha activity (8-12 Hz) is considered a basic rhythm of brain assemblies. Alpha is an electrical potential fluctuating up and down at a rate between 8 to 12 times per second. Increased alpha activity indicates enhanced correlation or coherent cell functioning in that local area detected by the EEG scalp sensor.
- Generally, alpha is indicative of more *self-referral processes* (restful alert, self-oriented, inner perception, wakefulness, etc.) in brain functioning compared to faster brainwave fluctuations that strongly correlate with processing of outside events or objects, i.e., more *object-referral processes*.

Gamma (25-50 waves/sec) Active, Sensory integration

Beta (13-25 waves/sec) Active, sensory-motor awareness

Alpha (8-12 waves/sec) Relaxed, inner-oriented awareness

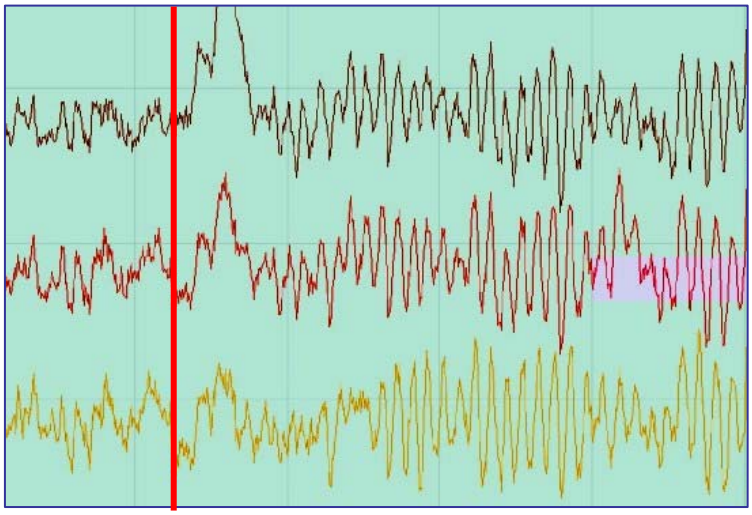
Theta (4-8 waves/sec) Working Memory, Sleep, Creativity

Delta (1-4 waves/sec) Deep Sleep, no awareness

Part 3: EEG Power—A Measure of *Locally* Coherent Brain Activity

Summary: Brainwave POWER is a measure of the strength or amplitude of the electrical signal detected at one point on the scalp. Thus, the power detected by EEG is directly related to the degree of correlated fluctuations or activity of the local underlying mass of brain cells at that moment of time. The more cells in a local region that fire together the greater the signal strength or power of the signal. Power fluctuations within different frequency bands suggest different modes of brain computation and awareness. During the TM technique the power spectrum rapidly shifts from a complicated, low amplitude, diverse frequency pattern to one of great simplicity, great unity—mainly high amplitude, nearly pure alpha activity.

- Since the activity of cell assemblies varies continuously over time, brainwave power measured at the scalp will vary as well.
- Since POWER is a measure of the degree of correlated or coherent cell activity in a localized region of the cortex (some of the several million cortical cells in about a 3-4cm diameter zone), a small percentage of cells acting coherently can create great changes in power because the activity of most of the cells is diverse and the summation of the diverse fluctuation in a local area tends to cancel (averages out to zero) and prevent any significant contribution to the brainwaves.
- Thus, EEG power indicates coherent, integrated functioning of cells in a local brain area. We can refer to this activity as an expression of 'local' coherence of cell functioning.
- Because brain cells can fluctuate in their activity at different rates or frequencies--slow, medium and fast—we can measure power for each frequency.
- Alpha activity represents the electrical potential fluctuating up and down at a rate between 8 to 12 times per second, or cycles per second. Alpha power is a measure of the strength of a very basic rhythm of brain assemblies.
- During TM, alpha power rapidly increases to a high level indicating the rapid onset of higher correlation of activity under each scalp sensor. In the figure to the right, EEG is shown for three sensors measuring the front, top and back of the head over about 9.5 sec. Note the rapid shift on beginning TM at time marked by the red bar.



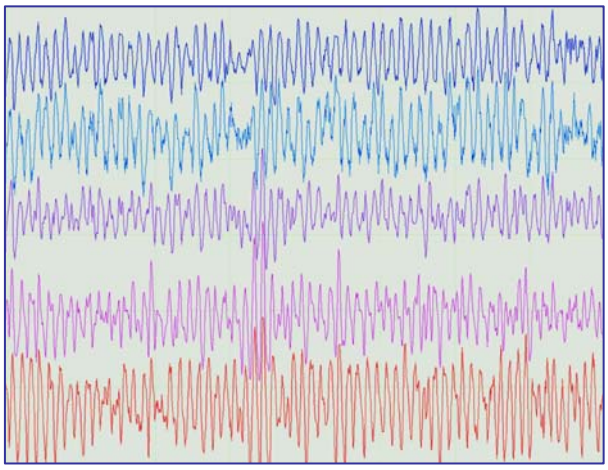
The one large wave immediately following the red line is from the electrical activity of the eyes as the person closes them at the beginning of TM. Also note this large wave generated by the eyes closing is maximum in the front of the head near the eyes (top trace) and negligible at the back of the head (bottom trace). Note that each area of the cortex shifts together from diverse, low power EEG to high levels of alpha power or *local* alpha coherence. Notice that all three signals shown here from different scalp locations look very similar. This will be discussed below as global coherence.

- Be aware that because the high degree of alpha power during TM is largely dependent upon how cells in a local area of the cortex are working together in a coherent manner, we like to use the term LOCAL coherence, based on the origin of the signal strength. This term is one we use in our research, but is not widely used in the field where researchers prefer the original designation of POWER, based on amplitude of the signal. So, one can speak either of changes in power or local coherence and mean the same thing.

Part 4: EEG Coherence—Distant Correlation of Brain Function

Summary: Coherence is a standard measure of correlated activity. In addition to *power* which is a measurement of *local* values of correlated (or 'local coherence') brain cell activity, correlated brain activity separated by large *distances* can also be detected and measured between neural assemblies. This distant correlation is referred to as EEG *coherence*. Remarkably elevated brainwave coherence during the Transcendental Meditation technique is significantly correlated with a variety of positive, desirable mind-body characteristics.

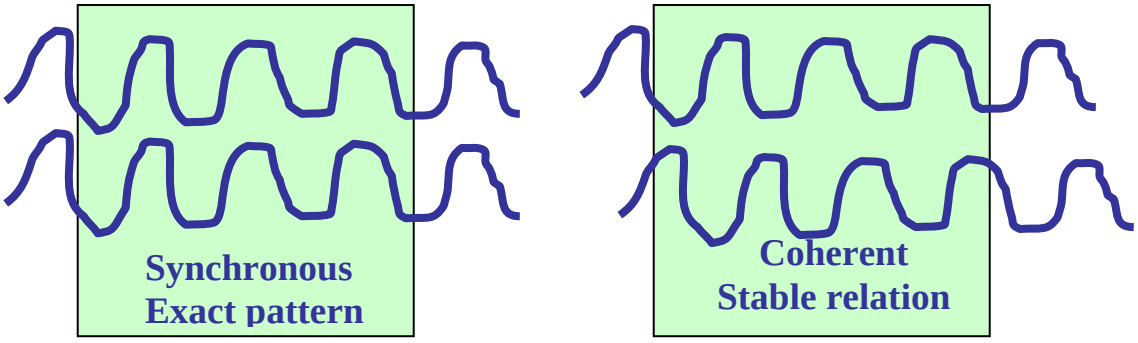
- *In general scientific language*, coherence (COH) is a measure of correlated activity of a number of elements in a system: people, cells, EEG signals, etc. In physical systems, laser light is coherent light. In biological systems, a small percentage of brain cells working coherently can control attention and consciousness.
- In brain research, especially EEG, coherence is a specific measure of correlated functioning that is not local but between widely separated neural assemblies in the brain, for example, between cells on the left and right side of the brain.
- In contrast, the term power refers to correlation in a small region. In our research we speak of EEG coherence or distant or global coherence as measures of brainwaves from two different areas of the brain. Standardized mathematical analysis generates a measure of the degree of COH. COH is generally calculated over a period of 1-2 seconds of EEG signal.
- So, when distant brain cell assemblies are functioning holistically together over a period of time, they tend to display similar or correlated electrical fluctuations, and as a result they display very similar brainwave patterns on the scalp.
- This marked similarity of EEG patterns across the scalp is evident in the figure to the right with 5 scalp sensors aligned from the very front to back of head.



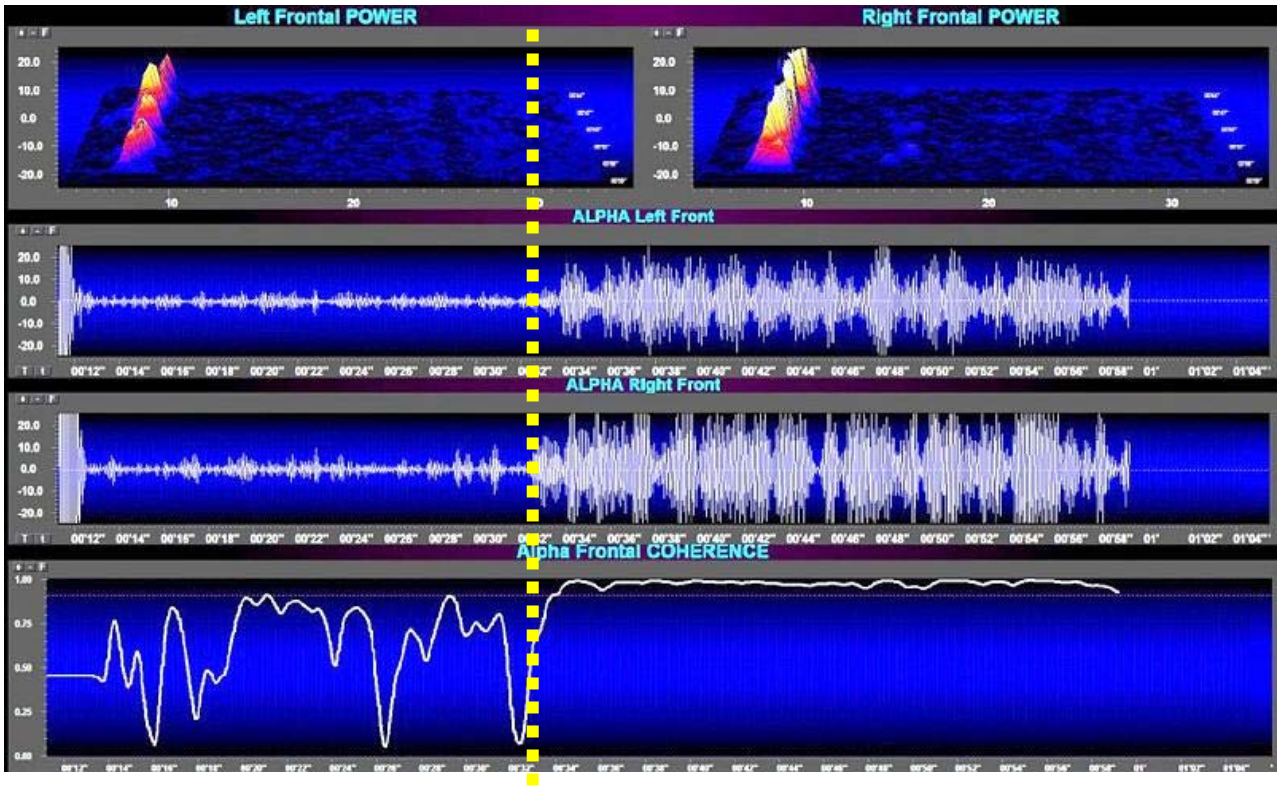
- Based on similar brainwave patterns, we say that different widely distributed assemblies are functioning in some degree of integrated, coherent or synchronous fashion.
- COH versus SYNCHRONY: These terms refer to similar but different styles of correlated activity.
- *In analytic language*, COH and SYNCH have specific mathematical definitions. COH is a measure of stability or endurance of alignment of the fluctuations of two electrical signals. This is called *phase stability* of the signals. COH is calculated as the

phase stability of signals between two given EEG leads over a short period of time, usually a second or so, for a specific frequency component.

- An piece of music can be appreciated as a whole and also on the level of individual instruments that contribute that wholeness. Similarly, any complex wave pattern (music, brainwaves, etc) can be broken down or decomposed into numerous specific, more elementary component waves of specific frequency and phase. Therefore, what is measured in coherence calculation is the phase stability of a particular frequency component.
- So, one can calculate the degree of coherence for each frequency component, delta, theta, alpha, etc. These values of coherence or stability of phase relation can then be plotted in a graph on a scale of 0 (minimum) to 1.0 (maximum) for each time epoch depicting the level of correlation between two signals over time for a specific frequency band like the alpha band.
- COH is the stability at any given phase relationship over time. In contrast, SYNCH is a specific type of COH requiring that the two brainwaves are exactly alike (completely in phase), or nearly so. Notice in the graph below left, during the period of analysis (green box) the two waves are nearly identical in shape and alignment, hence synchronous as well as coherent.

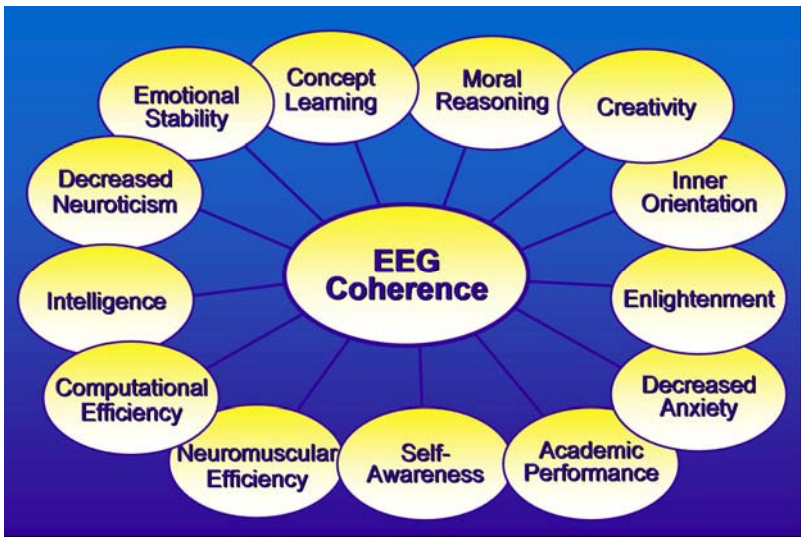


- Like SYNCH, COH brainwaves move together over time but, in contrast to SYNCH, COH brainwaves do not have to be identical or perfectly aligned in phase at each moment (see graph on right). Whatever the alignment is and whatever the difference may be, to the degree this relationship is maintained (remains stable) for the one or two seconds period of consideration that will generate specific value of COH between the two signals.
- More stability between the signals means higher coherence, values closer to 1.0 or maximum.
- Alpha coherence, especially in the frontal brain areas, is found highly correlated with the experience of Self, Transcendental Consciousness, during the Transcendental Meditation technique. This level of alpha coherence is only reported to occur during the practice of TM.
- High levels of brainwave coherence measured and displayed by the Nexus-10 EEG system is shown in the figure below. The time duration from left to right is about 60 seconds.
- Note that at the start of TM (dotted line in figure below) the alpha power or local coherence shifts quickly from low voltage, diverse frequencies to high amplitude, almost pure alpha in the front right and left sides of the brain. Only two sensors are displayed here for simplicity, but most areas of the cortex simultaneously go into this state. The power spectrum on top (little red and yellow colored peaks of power amplitude) shows



nearly all the power is in the low alpha frequency band (~8 cycles per second), evident in the simple wave pattern in the two middle EEG traces.

- At the bottom, is a trace of the calculated EEG (global) coherence. With the beginning of TM note the dramatic shift in coherence. Prior to TM, coherence between the two front sides of the cortex oscillates between very low and very high values about every two seconds. At the onset of TM, the shift in COH is nearly instantaneous, going to very high (>0.95 COH) levels, and remains there during the practice.
- With growth of higher states of consciousness, high levels of alpha coherence are also found during deep sleep and waking activity (see sections below).
- EEG coherence has been significantly correlated with a wide variety of beneficial mind-body characteristics and well-being (See the graph on right).
- In general, the highly coherent brainwaves indicate increased brain orderliness which future research is very likely to significantly correlate with improvements in all aspects of mind-body health, like cardiovascular health, mental health, longevity, etc.
- *Important exceptions:* High coherence can also be found in two other types of brain states, but the brain dynamics and corresponding EEG

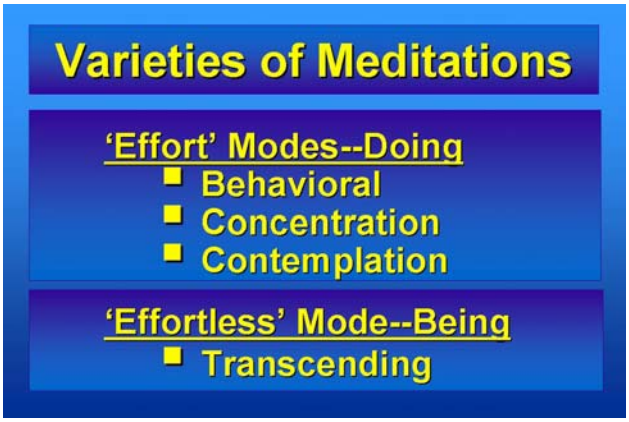


patterns are fundamentally different, usually involving very slow rhythms and altered states of awareness. In the normal process of deep sleep, for example, the very slow delta waves can be coherent, but the individual is asleep. Delta waves are not found in meditation unless an individual has a sleep deficit and momentarily falls asleep in meditation. Another example is epilepsy, in this case reflecting a unique pathological patterns of very slow brain waves and spikes can occur, again generally associated with loss of consciousness. Therefore, these types of brainwave coherence have no connection with the unique restful alert state during Transcendental Meditation practice shown by research studies associated with awareness, highly coherent alpha, and mind-body health (see more below).

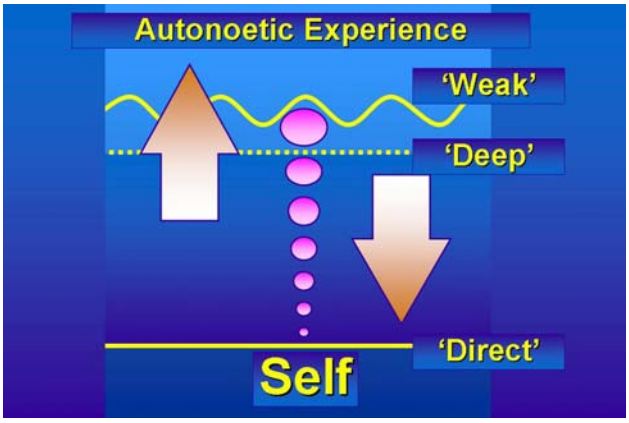
Part 5: Total Brain Functioning

Summary: The human brain functions on many levels at once, ranging from gross to subtle dynamics that correspond to and support the full range of mental processes that underlie our thinking, feeling and behavior. Human brain activity can be cultivated to more easily function from the deepest levels of nature's intelligence through the regular practice of Transcendental Meditation which permits the development of human potential in total brain functioning.

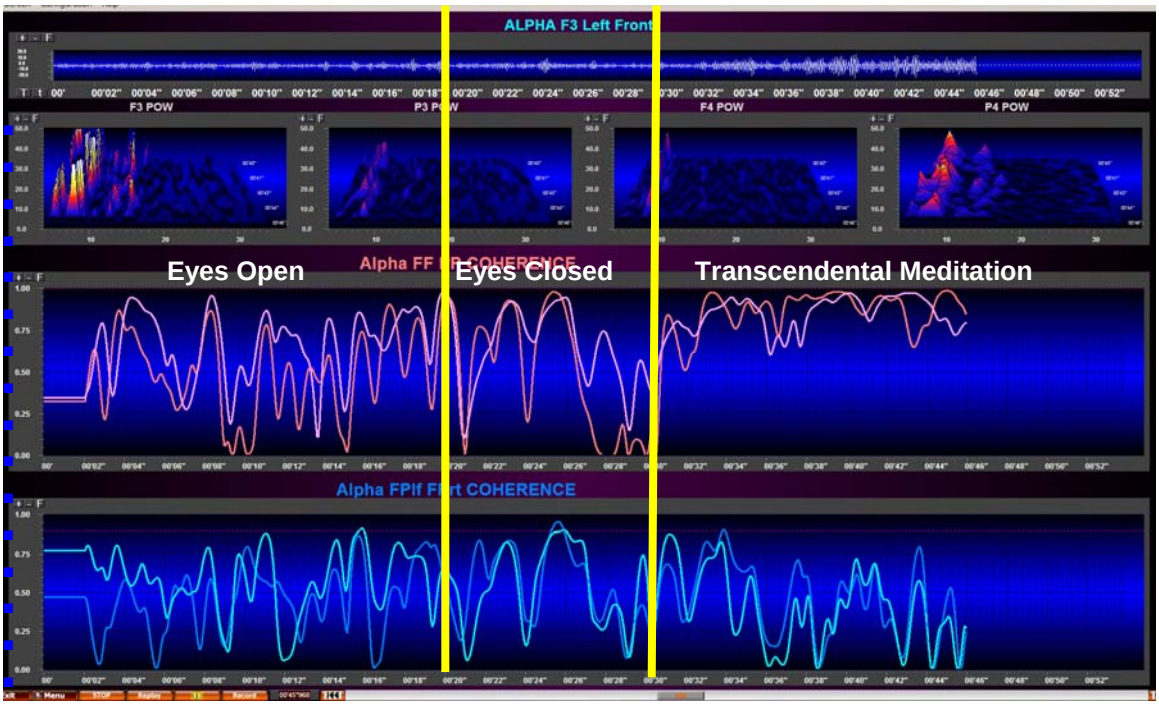
- Normally, in non-meditators, the electrical activity of different brain areas is only partially correlated and only for very brief periods of time. This more fragmented, less correlated, less coherent style of brain function is associated with thinking predominantly on the surface level of mental activity and is a less effective, less successful style of mental functioning.



- There are many forms of meditation, most of which require some intention, vigilance, analysis, appreciation and/or judgement (or nonjudgement). These techniques generate different experiences and different brainstates and resulting longterm benefits. What they share in common is the effort in the practice that disallows the mind to settle and transcend. The techniques can be considered object-referral techniques since the object is constantly referred to in practice, whether it be the breath, body, thoughts, sensory experiences, etc. In contrast, TM is an effortless, serl-referral mode of meditation that generates a unique experience of the self, global brain coherence and an amazing range of mind-body benefits.

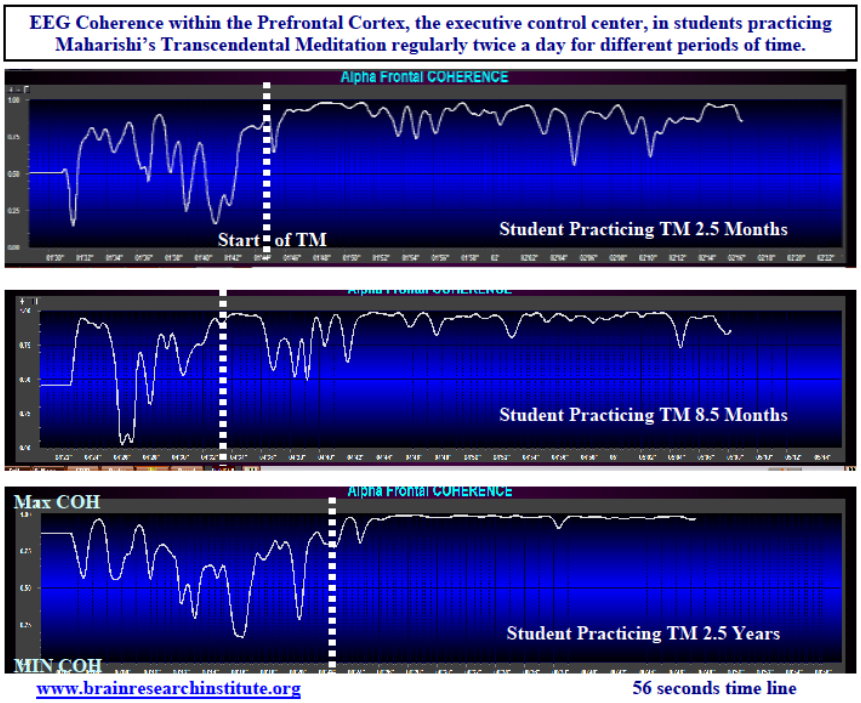


- When, through the practice of Transcendental Meditation, the process of regular transcending enlivens the full range of mental activity from gross to subtle, all levels and all areas of the brain



begin to function in a more correlated manner. As a result, the brain is acting more holistically, in a more integrated manner. This is seen in the Nexus research illustration above with front left EEG (top row, increase in power with onset of TM; total time displayed is 56 sec), four power spectra for front and back, left and right sides of head (primarily alpha, second row; last six seconds of period) and two rows of COH. Displayed is COH across the front (FF) and the back (PP) of the brain (middle graph) and between the front and back on left and right sides (bottom row). Note that with eyes closed, little happens in way of change in brainstate based on coherence. On beginning TM, the coherence increases in front and back and in this meditation, the left and right sides of the brain become more correlated.

- The regular experience of transcending cultivates correlation or integration of neural assemblies. This happens very fast, within weeks and months of practice (see Nexus graph at right). This habit of correlated function through regular practice produces over time a more holistic style of brain functioning, total brain functioning, full integration. Total brain function can be understood in terms of the co-existence of Self-Referral and Object-Referral



functioning (see below).

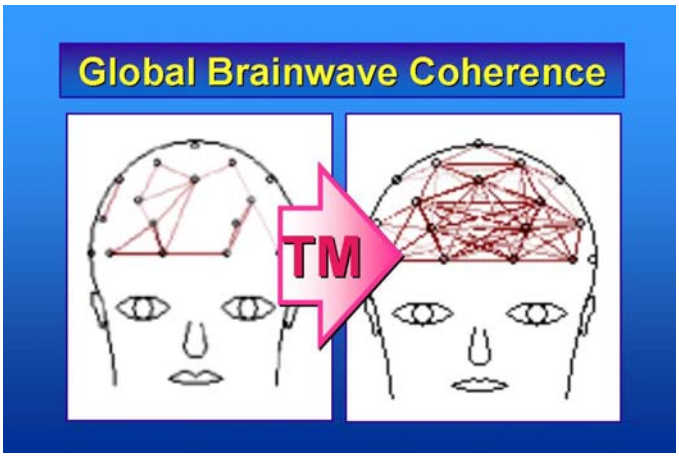
- Our processing of outer aspects of life is conducted by object-referral processes that underlie our sensory and motor functions. Self-referral processes support inner wakefulness that in turn provide a platform for object-referral activity. We need to be awake to function. The more awake we are, the better we function.
- The development of maximum brain integration makes available more comprehensive and reliable knowledge to support thought and action for success in life. When the brain becomes globally coherent, awareness can have access to the total structure of nature's intelligence in Transcendental Consciousness.
- Transcendental Consciousness is the level of Veda, total knowledge. Hence, the human brain has the inherent capacity for total brain functioning and can access Veda through cultivating the brain structure with regular experience of transcending balanced by daily activity.
- The spontaneous ability to function from the infinite potential on the level of Veda to the maximum expression of creative intelligence in daily life can be called Vedic brain functioning. This would express appreciation for the value of Vedic Science to bring fulfillment to modern research as it unfolds in the years to come.

Section 2: Overview of Brainwave Research and Growth of Higher States of Consciousness

Summary: Since 1970 and Dr. R. K. Wallace's ground-breaking research at University of California at Los Angeles, brainwave studies of the Transcendental Meditation technique have shown remarkable changes in brainwave coherence—indicative of increased integration and holistic functioning.
These changes can be seen:
(1) Within a short time after learning the practice,
(2) Rapidly rise with beginning meditation,
(3) To extend globally over the cortex,
(4) At very high levels, and
(5) And are sustained in most cases during the meditation.

With regular meditation practice, brainwaves patterns indicative of Transcendental Consciousness can coexist with waking and sleep states of consciousness — indicating growth of Higher States of Consciousness.

Much of the research shows increased coherence in frontal areas of the brain, the executive control centers, or "CEO" of the brain. This indicates the profound nature of integration of brain functioning. Brainwave coherence from the practice is associated with dramatic improvements in many areas of cognitive, emotional and physiological function.



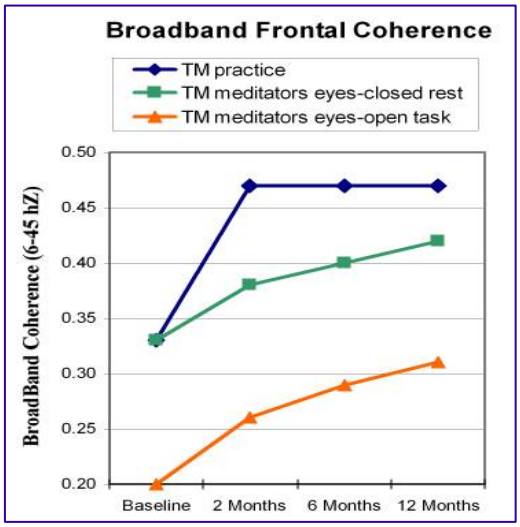
Part 1: Brainwave Patterns <u>During</u> the Transcendental Meditation Technique

Summary: Some 35 years of research have shown that the effortless practice of the Transcendental Meditation technique leads to remarkable levels of correlation of brain activity leading to both local and global coherence and integration. A few studies reported on brainwave activity during specific substates that can be identified during meditation.

- **Increase of amplitude of frontal theta and alpha brain waves** during practice of the Transcendental Meditation technique was <u>first reported</u> in Dr. R. Keith Wallace's doctoral dissertation at UCLA (Wallace, 1970). This increase in brainwave amplitude or power arises from increasingly coherent functioning cells beneath the EEG leads during the practice.
- **Increased 'wakefulness' during TM** practice was reportd by Banquet and Sailhan in 1974. They examined the ratio of alpha over delta and documented large increases in this 'wakefulness coefficient', apparently mainly due to large increases in alpha power.
- **Balance in frontal cortical activity** or balanced laterality was found by Travis, etal. This is in contrast to other techniques which can bring about activation of one hemisphere over the other.
- **Very high frontal coherence (inter-hemispheric coherence) and very high frontal-central coherence (intra-hemispheric coherence)** were the <u>first published findings of coherence</u> in meditation reported by Dr. Paul Levine, a pioneer in the measurement of brain wave coherence (Levine, 1976). This study placed coherence as a measurement and TM as a technique in world attention and has been the springboard for all other studies since. Today, some 36 years later, coherence and synchrony are universally recognized as fundamental modes of brain functioning underlying integrative information processing. I It remains a fact that TM produces remarkably high levels of coherence, not duplicated by any other intervention since Paul's seminal paper.
- **Enlivenment of the brain's latent resources** reported by Dr. Lyubimov, Director of the Brain Research Institute in Moscow. Lyubimov <u>stimulated the nerve</u> of the thumb during practice of the Transcendental Meditation technique. During practice of the Transcendental Meditation technique, he found the brain's response to this simple stimulation showed greatly expanded frontal areas of activation and analysis compared to the usual restricted zone of processing (Lyubimov, 1999). This suggested that during

TM, synaptic connections that are present but not strongly represented can be activated indicating an expansion of brain areas participating in sensory processing, ie, increase use of latent resources of the brain.

- **Higher frontal alpha coherence and higher global alpha power** were reported by Dr. Travis and colleagues during the process of transcending ('inward' stroke), and compared to the brain activity during the 'outward' stroke as defined by the brainwaves measured before and after spontaneous breath suspension, a reliable marker of the state of transcendence or self-referral consciousness. Also reported were lower breath rate and higher 'respiratory sinus arrhythmia' (the normal fluctuation in heart rate or rhythm associated with each inhale and exhale of the breath). This latter measure indicates an increase in the level of parasympathetic activity—the "rest and restoration" part of the nervous system (Travis, 2001).
- **Higher frontal coherence** during the first minute of Transcendental Meditation practice compared to eyes-closed rest. Transcendental Meditation practice was also characterized by lower breath rate, higher respiratory sinus arrhythmia, and lower skin conductance levels. This latter measure indicates a reduction in the level of sympathetic activity—the "fight or flight" part of the nervous system (Travis and Wallce, 1999). This study demonstrated the simple fact that transcending is an effortless process that does not take practice and occurs at the very beginning of sitting to meditate and does not take either months or years of practice or a long period of meditation to achieve.



- **High broadband (6-45 Hz) frontal coherence** is produced during the TM practice in a relatively short period of time, at just two months practice of the Transcendental Meditation technique compared to eyes-closed resting before beginning the practice. Broadband coherence includes the coherence measures for most of the EEG frequencies: theta, alpha, beta and gamma. As a longitudinal EEG study**,** this high level of broadband frontal coherence during the practice was also seen at 6 and 12 months of practice of the Transcendental Meditation technique (Travis etal). It is said that individuals practice TM not to access this unique state of restful alertness, but practice to stabilize this style of brain integration into waking, dreaming and sleeping states of consciousness as a fundamental means of improving brain processes over all states of consciousness and hence improve mind-body health.

Part 2: Brainwaves Assciated with the Experience of Transcendental Consciousness

Summary: The subjective experience of Transcendental Consciousness correlates with the appearance of spontaneous quiescence of the breath. Brainwave measures during this period of time in meditation show increased coherence.

- **Transcendental Consciousness** is identified objectively by a spontaneous change in breathing of the meditator. A period of suspension of normal respiration lasting from less

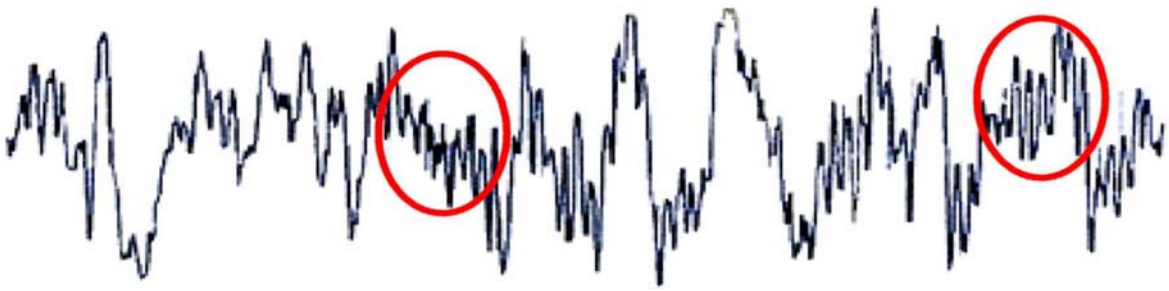
than a second to half a minute—spontaneous breath quiescence—is the most consistent pattern reported corresponding to the subjective experience of Transcendental Consciousness. (Farrow, 1982; Badawi et al, 1984; Travis and Wallace, 1997)

- **Coherence** during periods of spontaneous breath quiescence (Transcendental Consciousness) increases in specific slow frequencies—Theta and Alpha (Farrow and Hebert, 1976). EEG coherence was also reported to increase when all frequencies were added together (Badawi et al, 1984).
- **Skin conductance** changes, indicating that one's attention or perceptual orientation has shifted, has also been reported at the beginning of spontaneous breath quiescence periods (Travis and Wallace, 1997).

Part 3: Brainwave Patterns Associated with the Experience of Cosmic Consciousness

Summary: When the brain activity can support simultaneous unbounded, self-referral consciousness along with daily waking and sleep consciousness, research studies show existence of brainwave patterns indicative of both states occurring simultaneously.

- **Subjective Criteria for Cosmic Consciousness.** Cosmic Consciousness is the first of several Higher States of Consciousness and is defined as the co-existence of Transcendental Consciousness (TC) along with waking, sleeping and dreaming states of consciousness. This experience of co-existence of states of consciousness is commonly called 'witnessing.'
- **Objective Criteria for Cosmic Consciousness.** Cosmic Consciousness requires that characteristic physiological patterns of two states—Transcendental Consciousness with Waking, Dreaming or Sleep—are found to co-exist. In published research to date, two types of experiments have objectively documented this remarkable co-existence.
- **During Sleep: Greater theta and alpha amplitude** is seen during sleep in individuals reporting the experience of higher states of consciousness. These individuals show "normal" levels of delta activity (the big, slow waves below) indicative of deep sleep (Mason et al, 1997). However, in the graph, note the alpha waves, highlighted in several obvious cases in red circles, 'riding' the large amplitude delta waves. The alpha can be seen riding the delta rhythm throughout the tracing. Research shows there are significantly more alpha spindles during sleep in these individuals compared to normal controls.

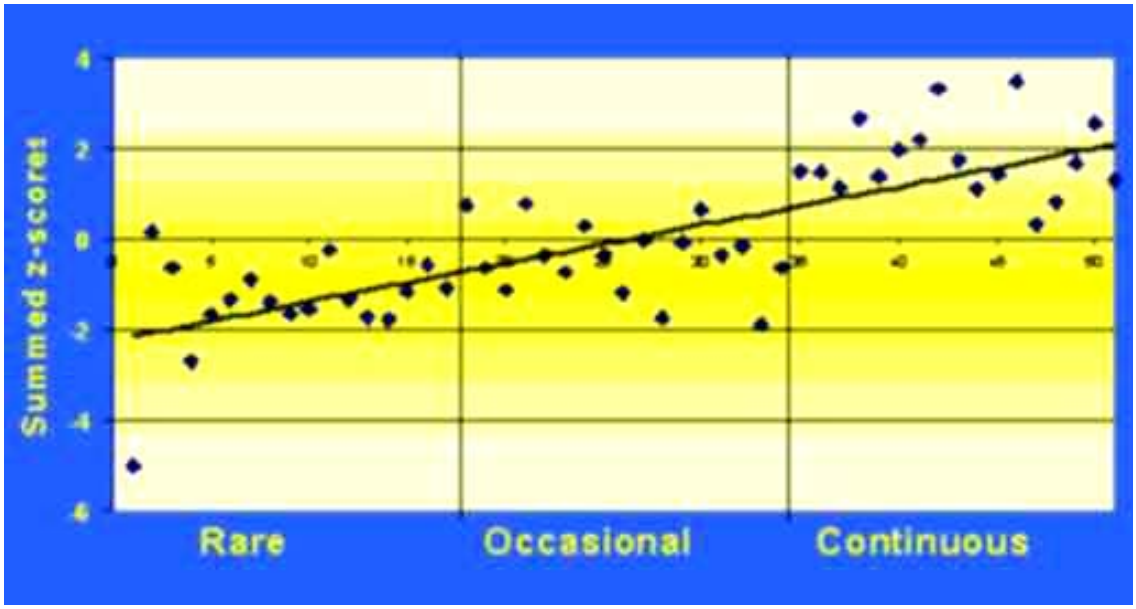


- **During Waking**: A number of unique brainwave patterns were identified in individuals in the waking state (during mental tasks involving reaction time) who report the

experience of higher states of consciousness. These three measures are used to produce an index or scale of integration of brain function called the Brain-Based Integration Scale (see graph below). Three groups of individuals reporting distinctly different experiences were examined with an EEG and neuropsychological tests. Individuals were assigned to a group if they had little or no experience of witnessing (rare group), inconsistent, varying experience of witnessing (occasional group) or constant experience of witnessing (continuous group).

- **The main EEG measures distinguishing group membership** (Travis et al, 2002) are:
  - **Greater broadband (6-45Hz) frontal coherence**.
  - **Greater alpha** (associated with restful alertness) and **lower gamma** amplitude (associated with object perception).
  - **More appropriate/efficient brain response during problem solving** as measured by averaging the brain response.

These three measures were used to calculate a four measure, here referred to in the illustration below as "summed z-scores" for each participant and their group membership. The line drawn through the population sample illustrates the ability to predict group membership with high reliability of anyone from a sample of EEG data recorded during waking state activity. This research is the first published report in the scientific literature of an objective measure of growth to enlightenment, removing the notion of a highly integrative consciousness and lifesytle from the perennial grip of mysticism.



Brain-based Integration Scale of Growing Enlightenment

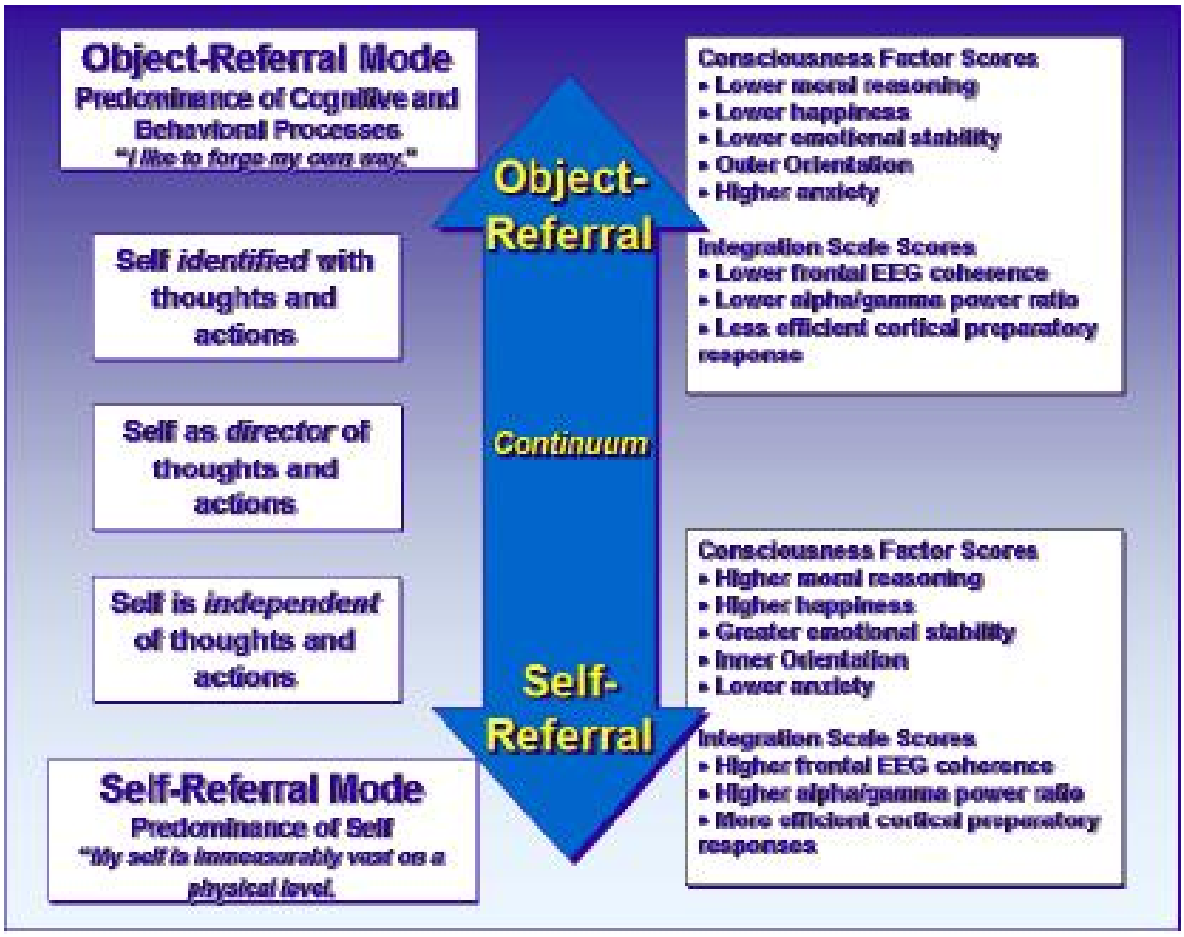
- **Subjective**, **self-reported descriptions** of sense-of-self development of higher states of consciousness (See graph below; Travis et al, 2004).

A model of a <u>Self-Referral/Object-Referral Continuum</u> in human development:

  - **Object-referral predominant sense of self**—Non-meditating individuals identified their self with their thoughts and actions.

- **Intermediate state of self recognition**—Meditating individuals, who did not report clear experiences of higher states of consciousness, described their selves as the director of all their thoughts and actions.
- **Self-referral predominant sense of Self**—Meditating individuals reporting the experience of higher states of consciousness described their selves as underlying and independent of all thoughts and actions—a silent awareness lying under all activity.

- **Neuropsychological standard tests** also show significant levels of self-development in individuals reporting higher states (Travis et al, 2004):
  - Higher moral reasoning
  - Higher emotional stability
  - More inner orientation of life
  - Lower anxiety



- **Brain Integration Report Card** is derived from a combination of the above brainwave and personality measures. This analysis allows an individual to follow their growth in brain integration over time. This measure can be used in any segment of society to evaluate the degree of brain integration and conscious development, the basis of evolutionary, harmonious and successful thinking and behavior.

- **Higher States of Consciousness**: Ongoing brainwave research will help us to distinguish individuals primarily reporting experience of Cosmic Consciousness, God Consciousness, and Unity Consciousness.

- **Yogic Flying and Brainwave Integration:** Yogic Flying is a component of Maharishi's TM-Sidhi Program and, over the last 25 years, the practice of Yogic Flying has been scientifically documented to enhance brainwave coherence and to improve the quality of life for the individual and society.
  (see http://brainresearchinstitute.org/research/yogic_flying/index.html).

- **Vedic Recitation and Brainwave Response.** Ongoing research indicates that while listening to the sounds of Veda and the Vedic Literature, the brain becomes highly synchronous. This suggests that Vedic sounds can enliven brain integration and facilitate the development of total brain functioning.

- **Maharishi Sthapatya Veda and Brainwaves.** Preliminary research suggests that dwelling in a structure with proper orientation can have an effect on brain function as well as a number of positive influences on mind-body health.
  (see http://www.brainresearchinstitute.org/research/architecture/index.html)

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