

Chapter Five

Monroe World— The New Lend of Hemi-Sync

In 1986, *a* couple of years before I retired from the army, I began building a house near Nellysford, Virginia, very close to The Monroe Institute, a nonprofit organization founded by Bob Monroe. In the intervening years since we first met in 1977, Bob had been softly suggesting that I could join the staff of the Institute. He never made a direct offer but rather hinted that there might be a position available if I was so disposed. This open door, coupled with my own internal Guidance, led me in the direction of The Monroe Institute as army retirement neared.

Family life on Fort Meade had been great. The kids had rotated in turn through the elementary, middle, and high schools. There were school bands and recitals, after-school sports, a broken arm, and a bicycle accident that led to a few knocked-out teeth. When all the kids were old enough to go to school, in the mid-eighties, Joan had gotten a job.

Those were the burgeoning days of computers in the workplace, and Joan had landed a position with a growing company. She had become a valuable company asset and slowly had become

more and more interested in her work and less interested in home life. I began to feel uncomfortable with the marriage as time passed. Perhaps I was jealous or felt abandoned, as she seemingly lost interest in family life. As military retirement approached, our lives drifted farther apart.

As I explained before, I relinquished my position as operations and training officer for the remote-viewing unit in the summer of 1987. I went on terminal leave from the army and left Fort Meade in December 1987, and we moved into the new house I had built in Virginia. I was officially retired from the army in February 1988.

Shortly after we moved to Virginia, Joan and I separated. She moved back to her job in Maryland. The separation led to an amicable divorce after being married twenty years. Although we have both remarried, we remain friends. She has since advanced her career and become an information systems manager for a large retail chain. She has my respect and gratitude for all the affection we shared during our twenty-year marriage and for our three beautiful children. I will always love her.

A New Career

Retiring from the army and moving to Virginia without a specific job offer might seem like a risky thing to do. But I had grown to trust Guidance as expressed through gentle feelings and a sense of divine-right-action. It was not as though I heard a booming voice say, "Retire from the army, move to Virginia, and get a job at The Monroe Institute." I just knew in my heart it was the right thing to do.

An understanding of the technology time window is important here. In the mid- to late-eighties, desktop office computers began to change the workplace forever. Personal ownership of a computer, a concept shared by only the most forward-looking entrepreneurs, became possible. I took to this new computer era with great enthusiasm. I bought a home computer and learned how to operate a variety of systems and to write my own applications programs. My electronics training from earlier years helped too. Guidance obviously had more on my agenda at the time than clandestine technical surveillance devices.

This new age of technology made widespread application of computerized electroencephalography, popularly referred to as "brain mapping," a reality. I found a fledgling company in Colorado called Lexicor Medical Technology that had developed a 24-channel, computerized EEG recording and analysis instrument. This remarkable-for-its-time system worked in conjunction with the latest in desktop computers—an IBM-compatible 286 with a 20-megabyte hard drive and 8 megabytes of RAM. I realize that such figures sound ridiculous by today's standards, but back then it was state-of-the-art.

Bob Monroe and I discussed the possibility of getting such a device for the Institute and using it to measure brainwave changes in people listening to Hemi-Sync. Ever since my experience "through the Flavor Straw" back in 1977, I had been curious. What was it about Hemi-Sync that made this journey possible, and how was it that Bob ever came up with this sound technology?

Bob had told me at the time that my specific experience was the result of my metaphysical upbringing and my intent. But my curiosity went further. Do the Hemi-Sync sounds alter brain activity and consciousness?

Bob assured me that this was probably true but there was no objective evidence to demonstrate such changes. But now, with the advent of desktop computers, such measurements would be possible outside a multimillion-dollar medical diagnostic facility. Bob sent me to Colorado to check out the Lexicor device.

During this same period of time (I still did not have a new job after my army retirement), I programmed my home computer, which was equipped with a stereo sound card, to produce complex binaural beats—the stuff of Hemi-Sync. I packed up my computer and took it to Bob to show him how computers could be used to produce his Hemi-Sync sounds. He was skeptical at first; then he asked me to "dial in" a few different binaural-beat patterns.

The short version of the rest of the story is that I did not leave with my computer. Bob was truly amazed. For years, he had been mixing together many layers of sounds from analog tape through a multi-channel audio mixing board. This method took hours and

hours of work. With a computer, such mixing became obsolete as such combinations could simply be programmed into the sound card.

When I came back from Colorado and explained to Bob how the Lexicor device worked and what it would reveal, I recommended that he get one for the Institute. He asked me if I could operate it and the computer we would need to buy. I assured him that I could. It was only then, in June of 1988, that Bob actually offered me a job at the Institute.

After a provisional ninety-day hire, during which I set up and began to use the Lexicor, Bob offered me the position of research director at the Institute in September 1988. He was in fact inviting me to join him in a scientific journey on a course charted to discover the why and how of Hemi-Sync.

The rest of this chapter describes the journey from Bob's intuitive foundation in the 1950s and 1960s to the rapidly evolving field of neuroscience at the dawn of the twenty-first century and our current understanding of the Hemi-Sync process.

In the Beginning

Originally, Bob was interested in sleep-learning and wanted to develop a way to prolong those lighter stages of sleep wherein most sleep-learning seemed to occur. He experienced his first conscious out-of-body escapade only after many Hemi-Sync sleep-learning experiments.

Ever since the late 1950s, first Bob Monroe and then the Institute have been identifying propitious states of consciousness and developing various Hemi-Sync signals to induce them. The process of developing effective Hemi-Sync binaural beats has been as complex as the functions of the brain itself.

Under laboratory conditions, Bob Monroe originally tested many subjects for their subjective and objective responses to binaural beats, and recorded the effect on them of each binaural beat frequency. Then binaural beats were mixed and subjects' responses were again recorded.

After many months—years in some cases—test results began

to show population-wide singular responses to specific mixes of binaural beats, which laid the foundation for what are now called Hemi-Sync focus levels. The Hemi-Sync technology was eventually patented.¹⁴

Bob tried to describe Hemi-Sync as an auditory-guidance system that uses sound pulses to somehow *entrain* beneficial brain-wave states. He said that Hemi-Sync seemed to be able to heighten selected awareness and performance levels while creating a relaxed state.

But could this be true? And if it was, how did all this work? Could sound pulses somehow *entrain* the electrical activity of the brain? Resonant entrainment of oscillating systems is a well-understood principle in the physical sciences—but was it the mechanism behind Hemi-Sync?

Although Bob found that Hemi-Sync, actually the well-recognized phenomena of binaural beating, enables focused states of consciousness and, for some, provokes the realization that they are more than their physical bodies, little was known about the mechanism—the so-called neural underpinnings of the process.

In the early years, it was assumed that the mechanism behind the consciousness-altering effects of binaural beats was somehow related to the frequency-following response. It was postulated that prolonged exposure to binaural-beat stimuli influenced brainwaves to the point of altering ongoing EEG through *entrainment* of the perceived rhythmic pulsing.

Since an auditory, frequency-following response could be measured at the brain's cortex, it was theorized that such entrainment imposed some sort of pattern on the nonlinear, stochastic resonance of brainwaves by means of the frequency beating of the auditory stimulus. Some erroneously called this "entrainment of the frequency-following response." This of course makes little sense, because a "response" is, by definition, a reaction to something and not in itself causative.

a. Patent Number: 3884218; Issue Year: 1975

b. Patent Number: 5213562; Issue Year: 1993

c. Patent Number: 5356368; Issue Year: 1994

The Bob Monroe Research Lab

Even before I became the research director, I was fascinated with the concept that Hemi-Sync altered consciousness. I assumed this meant that the sound patterns somehow changed brainwaves. At first, I thought that Bob must have based the Hemi-Sync frequencies on his own brainwave states. So I began searching for some documentation of Bob's brainwave state during his out-of-body adventures.

I found it in the *International Journal of Parapsychology* and the *Proceedings of the Parapsychological Association*. The *journal* article reported a study of Bob Monroe's brainwave state during two brief, self-induced out-of-body experiences. The recorded brainwave state resembled Stage One sleep, but Charles T. Tart, the principal investigator, reported that this identification was somewhat ambiguous because of exceptionally high variability in Bob's brainwave patterns.¹⁵

The *Proceedings* article said that Bob also reported two brief out-of-body experiences.¹⁶ He had awakened within a few seconds after each one, which allowed for correlation of physiological recordings with the experience. Brainwave patterns immediately prior to and continuous through the first experience were roughly classified as a borderline or hypnagogic state, a brainwave pattern containing bits of slowed alpha rhythm (indicative of drowsiness) and theta activity (a normal sleeping pattern).

This pattern persisted through the time period Bob reported as his first out-of-body experience and was accompanied by a sudden fall of systolic blood pressure lasting seven seconds, the estimated length of the out-of-body experience. The second out-of-body experience appeared to have been accompanied by similar brainwave patterns.

The two studies of Bob's out-of-body experiences showed that

¹⁵"A Second Psychophysiological Study of Out-of-the-Body Experiences in a Gifted Subject," *International Journal of Parapsychology* 9 (1967): 251-258. W. Roll, R. Morris and J. Morris, eds. "A Further Psychophysiological Study of Out-of-the-Body Experiences in a Gifted Subject, Robert A. Monroe," *Proceedings of the Parapsychological Association*, 6 Nov. 1969: 43-44.

his escapades seemed to occur in conjunction with a prolonged and deliberately produced hypnagogic state (Stage One sleep). Such sustained states are not normally seen in the laboratory. Additionally, the preponderance of theta rhythms and the occasional, slowed alpha showed an intriguing parallel with brainwave states reported for advanced Zen masters during meditation. (The major achievement of these two studies was to demonstrate that the out-of-body experience can occur in a laboratory setting and is thus amenable to scientific investigation.)

So if Bob based the Hemi-Sync frequencies on his own brainwaves, hypnagogic theta with reduced alpha would be the logical place to start. When I asked Bob about this, he laughed and said that there was probably something to all this but that he had started developing Hemi-Sync long before he had had his first (conscious) out-of-body experience or had his brainwaves measured.

Early Understandings

If a tuning fork designed to produce a frequency of 440 Hz is struck so as to cause it to oscillate, and is then brought into the vicinity of another 440 Hz tuning fork, the second fork will begin to oscillate. The first tuning fork is said to have entrained the second, or caused it to resonate.

For one oscillating system to be capable of entraining another, the second system must be capable of achieving the same oscillating frequency. A 440 Hz tuning fork will not entrain a 300 Hz tuning fork because the second tuning fork will not vibrate at 440 Hz. Also, for one oscillating system to be capable of entraining another, the first system must have sufficient power or amplitude to overcome the homeostasis (stable state) of the second, and the first must be at a constant or fixed frequency. The tuning fork is an ideal example because it produces an oscillation of constant frequency and amplitude called a standing wave.

I postulated that the physics of entrainment applied to brainwaves as well. The electrochemical activity of the brain results in

the production of electromagnetic waveforms (brainwaves) that change frequencies based on neural activity within the brain and can be objectively measured with sensitive equipment, the EEC. I wondered if Hemi-Sync could actually change this activity.

It seemed to me that caffeine, nicotine, and alcohol could alter brainwave activity. The senses of vision, touch, and hearing also provide easy access to the neural functions of the brain. Each of these senses responds to waveform activity within the surrounding environment and transmits information to the brain. Do the senses of sight, touch, and hearing, by their very nature, provide a fertile medium for entrainment of brainwaves? A strobe light flashing at 10 Hz will entrain occipital brainwaves to its frequency. Could the sound technology Bob Monroe called Hemi-Sync entrain the brain in the same way?

The strobe-entrainment effect involves only one of the sensory channels. The sense of kinesthetic touch is another. In one interesting experiment, I found a researcher had set up a standing wave of a desired frequency in a waterbed. The resultant tactile signals were seemingly effective in entraining the subject's brainwaves to the selected frequency.

In the case of Hemi-Sync, is the sense of hearing providing the neural avenues by which entrainment signals can be introduced into the electromagnetic cranial environment? Brainwave researchers had measured a low-amplitude, frequency-following response to binaural beating, but this volume-conducted reflection of the stimulus beating does not represent ongoing or dominant brainwave activity. I needed to learn more about brainwaves.

There is a popular notion that one can tell what a person is thinking by measuring brainwave patterns. This is like saying that one can tell what information is in a computer by simply measuring voltages present at various points, which of course is impossible. A more realistic analogy would be the telephone.

A telephone has three states of consciousness: State one is standby—the telephone sits waiting to be used. State two is ringing—the telephone is actively soliciting attention. State three is

talking—the telephone is being used. All of these states of consciousness of the telephone can be determined by measuring the line voltage of the telephone wires. Direct access to the telephone itself is not needed in order to know what it is doing.

If 48 volts of direct current are present on the wires, the phone is in state one, or standby; if 100 volts of alternating current, the phone is in state two, or ringing. When there is a modulated 10-volt direct current on the phone wires, the telephone is in state three, or talking (being used).

These telephone states of consciousness, so to speak, are discrete in that the telephone cannot be in more than one state at a time. It is waiting, ringing, or talking. But measuring line voltage and determining that the telephone is in state three (talking) does not reveal what is being said over the telephone.

The same is true of brainwaves. Measuring brainwave frequencies and associative patterns and detecting REM sleep (dreaming) does not reveal the dream content. Only by awakening the subject and asking for a description of the dream can the experimenter discover this.

Brainwaves themselves exemplify arousal levels. They represent the electrochemical environment through which perceived reality is manifest. They do not reveal subjective or cognitive experiential content.

Recent Comprehension

My research into the literature revealed that the human ability to *hear* a binaural beat appears to be the result of evolutionary adaptation. Many species can detect binaural beats: The frequencies at which the beats can be detected depend upon the size of the cranium. In the human, binaural beats of up to 20 Hz can be perceived when carrier tones are below approximately 1500 Hz.¹⁷

The sensation of hearing binaural beats occurs when two

Carrier tones are the two sounds played via stereo presentation, one to each ear, that produce binaural beating.

coherent sounds of nearly similar frequencies are presented, one to each ear, and the brain detects phase differences between these sounds. In an open environment, this phase difference would provide directional information to the listener, but when presented with stereo headphones or speakers the brain integrates the two signals, producing the binaural beat. From the available literature, I discovered that binaural beats originate in the brainstem within the contralateral audio-processing regions of the brain called the superior olivary nuclei. Binaural beating is perceived as a fluctuating rhythm at the frequency of the difference between the stereo (left and right) auditory inputs.

This auditory sensation is neurologically routed to the reticular formation in the brainstem and simultaneously volume conducted to the cortex where it can be objectively measured as the frequency-following response. As I stated earlier, this does not necessarily indicate a change in ongoing brainwave activity. A complete understanding of all this was going to require some research on my part.

Hemi-Sync and Brain Function

I thought that an understanding of a possible neurological mechanism was important as foundation for the observed effectiveness of Hemi-Sync technology. I wanted to replicate the frequency-following response studies of other researchers to be sure, for myself, that binaural beats did in fact produce this EEG anomaly. This would also provide me a journey into the realm of academic research, a place I had seemingly not been before.

Hearing-acuity researchers had defined the "frequency-following response" as a brainwave-frequency response (measured by EEG) that corresponds to the frequency of an auditory stimulus. Previous hearing-acuity research had demonstrated a frequency-following response to binaural beating—proof that the sensation of binaural beating has a neurological efficacy.

However, a frequency-following response to binaural beats in brainwave frequency ranges usually associated with reported altered states of consciousness (e.g., theta states) had not, at this

point, been objectively demonstrated using appropriate evoked-potential EEG protocols.¹⁸

I thought that further study of frequency-following response would be vital in understanding the obvious effectiveness of the Hemi-Sync process and maybe would even lead me to a possible neurological mechanism.

The Frequency-Following Response Study

Following is a detailed description of an experimental procedure. It's pretty interesting and underscores the seriousness of purpose behind the work at The Monroe Institute, but you can flip forward a few pages to the "Meaningful Results" section if you want.¹⁹

It would have been easy to use an EEG machine to collect brainwave data while I had someone listen to Hemi-Sync. A simple evoked-potential data analysis would show if Hemi-Sync engendered a classic frequency-following response. But the task was bigger than I had imagined.

By using just one subject and one binaural-beat frequency, I couldn't be sure that results weren't due to chance. I needed to use several subjects and at least a couple of different binaural beats. I finally wound up with seven subjects and a small experiment designed to objectively verify a frequency-following response to both theta and beta binaural-beat stimuli through the use of an appropriate evoked-potential protocol.

The study was designed to determine if a 7 Hz (theta) binaural beat would result in a 7 Hz frequency-following response in the brain, and if a 16 Hz (beta) binaural beat would engender a 16 Hz response. I chose these frequencies because they were similar to the frequencies usually embedded within Hemi-Sync patterns.

In order to see if the binaural beating stimulated a frequency-following response, I had to compare EEG recordings taken while

Evoked-potential studies use time-domain averaging of a number of EEG responses to mathematically isolate and identify stimuli that would otherwise be overwhelmed by ongoing brainwave activity.

An academic version of the frequency-following response study is provided on the companion CD-ROM.

listening to the beating with some other condition. Silence could be one (baseline) condition, but I also thought it would be interesting to see the effect of using a nonbeating (placebo) sound.

In more scientific terms, the hypothesis of the study was that subjects exposed to a binaural-beat stimulus would evidence increases in amplitude of time-domain averaged EEG in frequencies matching that binaural-beat stimulus (the frequency-following response) when compared to a silence-baseline condition.

Additionally, I expected an elevation in overall EEG amplitude (an arousal response, not a frequency-following response) in the case of a nonbeating stimulus (placebo) and the alternative binaural-beat stimulus.

This may seem pretty complex, but if my hypothesis proved valid, I would be able to see significant increases in 7 Hz and 16 Hz EEG amplitudes during comparable binaural-beat stimuli periods, as compared to the silence-baseline condition. And this result would, of course, imply the development of a frequency-following response to binaural-beat stimuli.

In order to be sure that I got reliable results in the study, I decided to use both male and female subjects who had no prior experience listening to Hemi-Sync. I wanted to ensure that they wouldn't be simply exhibiting some form of conditioned response due to prior experience.

Also, to control for subject expectation, the two-second experimental stimuli periods (7 Hz, 16 Hz, and a nonbeating tone) were arranged in an eighteen-episode Latin-square protocol, which arranges the stimuli so that the subject cannot predict what the next stimulus will be based on previous exposure.

In order to automate the whole process and take the experimenter (me) out of the loop, I used a computer to present the audio stimuli. I constructed a series of sound files that provided the various stimuli. Each sound file was automatically played in the Latin-square sequence through a stereo sound card to the subjects' in-ear stereo headphones.

To isolate the subjects from intrusive stimuli, they were tested in the booth in the Institute lab, which is an isolated, double-wall,

soundproofed, and electrically shielded chamber. During the evaluation, subjects lay comfortably on a waterbed. To aid in the reduction of eye-movement artifact, a small, soft fabric bag filled with rice was placed over the closed eyes of the subjects. EEG recordings were made during the entire Latin-square protocol outlined above.

So, I had been careful to ensure this frequency-following response study was conducted with some due diligence. But what would the results show?

I found that subjects exposed to binaural-beat stimuli evidenced time-domain averaged EEG increases in frequencies matching binaural-beat stimuli when compared to the silence-baseline condition. Some elevation in EEG amplitudes in comparison to the silence-baseline condition was also seen in reaction to both the placebo stimulus and the alternative binaural-beat stimulus. All results were as set forth in the study's hypothesis.

There was no reliable evidence of a 16 Hz frequency-following response. Increases in 16 Hz time-domain averaged EEG amplitudes during the 16 Hz binaural-beat stimulus periods over the silence-baseline condition were statistically nonsignificant when the increases in EEG during the placebo and the 7 Hz binaural-beat stimuli were considered.

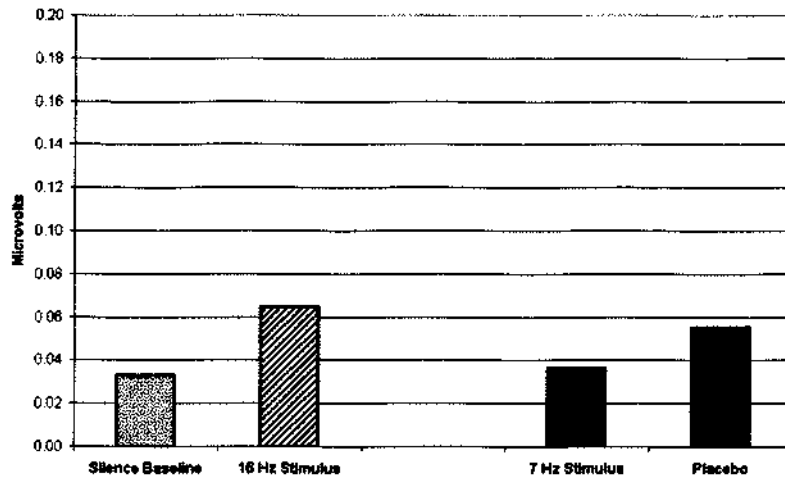
However, statistically significant ($p < .05$) increases in 7 Hz EEG amplitudes were demonstrated during the 7 Hz stimulus condition, which provided evidence of a 7 Hz frequency-following response during the 7 Hz binaural-beat stimulus periods even when the increases in EEG during the placebo and 16 Hz binaural-beat stimuli were considered in the statistical evaluation.

The following graphs show the anticipated arousal response to the placebo stimulus and the alternative binaural-beat stimulus as well as substantial EEG amplitude increases in the appropriate binaural-beat stimuli periods over the silence-baseline condition.

Meaningful Results

With this small study, I had objectively demonstrated a frequency-following response to binaural beats in brainwave

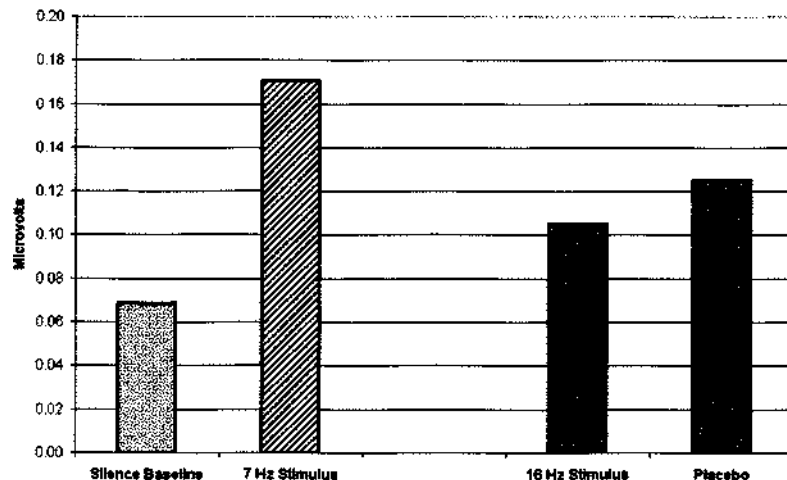
16 Hz Response



frequency ranges associated with discrete theta states of consciousness—the stuff of Hemi-Sync. This was a critical step in validating previous hearing-acuity research. This study also proved to me, personally, that binaural beats did in fact have a neurological impact.

But this only proved an auditory frequency-following response. It did not demonstrate that binaural beats have an ability to somehow

7 Hz Response



engender psychophysiological state changes, alterations in ongoing brainwave activity.

As I said before, decades ago it was assumed that the mechanism behind the consciousness-altering effects of binaural beats was somehow related to the frequency-following response. I wrote and spoke of this myself many times. However, at that point in my research, it was hard to even speculate that the very low-amplitude brainwave activity (represented by the frequency-following response) could in some electromagnetic inductive way modify ongoing brainwave activity. On the other hand, the mere presence of a frequency-following response to the binaural beats of the Hemi-Sync process in this study provided valuable evidence of the neurological impact of this stimulus.

Through further literature review, I found that there is no neurological effect-mechanism to support the notion that "entrainment" of binaural beating is responsible for alterations in brainwave arousal. The EEG signal strength of the measured auditory frequency-following response is extremely low, much too low to represent an overall ongoing brainwave state. Nevertheless, the frequency-following response to binaural beats remains an important aspect in understanding their potential state-changing effects.

Demonstrating the presence of a frequency-following response to the binaural beats in the theta range using evoked-potential EEG protocols provided me with some evidence of the neurological impact of the Hemi-Sync stimulus. So, what is the mechanism behind the observed changes in overall brainwave activity? With more recent research, I have taken a deeper look into the probable neurological mechanism involved in changing cortical arousal (ongoing brainwaves).

Neurology and Hemi-Sync

This is a rather in-depth look at brain activity as it relates to Hemi-Sync. You might want to flip forward a few pages to the section called "Altering Consciousness with Hemi-Sync."

Through further study of the available literature, I found out that ongoing brainwave activity is regulated by the brain's extended reticular-thalamic activation system. The neural-reticular formation is composed of a large, net-like diffuse area of the brainstem. The word reticular actually means "net-like."

The reticular activating system interprets and reacts to information from internal stimuli like feelings, attitudes, and beliefs as well as external sensory stimuli (like Hemi-Sync sound) by reactively regulating arousal states, the focus of attention, and levels of awareness. How we interpret, respond, and react to information, then, is managed by the brain's reticular formation stimulating the thalamus and cortex, and brainwave states of arousal.

So it seemed to me that in order to alter arousal states, attentional focus, and levels of awareness, it was necessary to provide some sort of information input to the reticular activating system. And therein appears to reside the neurological mechanism for the powerful consciousness-altering effects of Hemi-Sync.

If I understood the scientific literature, it would appear that Hemi-Sync provides information—the complex, brainwave-like pattern—that engenders cortical adaptation. The reticular activating system distinguishes the unique binaural-beat waveform arising within the brainstem as brainwave pattern information. If internal stimuli, feelings, attitudes, beliefs, and external sensory stimuli are not in conflict with this information (an internal, even unconscious, fear may be a source of conflict, for example), the reticular activating system seems to alter cortical arousal states to match the Hemi-Sync stimulus as a natural adaptive function.

In effect, as time passes the reticular activating system monitors the internal and external environment and arousal states, attentional focus, and levels of awareness to determine, from moment to moment, the most suitable way to deal with existing conditions. As long as no conflicts develop, the reticular naturally continues aligning the listener's brainwave activity with the information in the Hemi-Sync sound field.

The true mechanism, therefore, behind Hemi-Sync's ability to alter cortical arousal and consciousness is not brainwave "entrain-

ment" but adaptation to auditory stimulation of the reticular. This understanding of a neurological mechanism as foundation for the observed effectiveness of the Hemi-Sync technology was so important that I wanted to study this process further. Ever since my adventure "through the Flavor Straw," I had been seeking to discover a practical explanation of how Hemi-Sync works.

Altering Consciousness with Hemi-Sync

Our state of consciousness can be described as a balance of cortical arousal level and subjective content. The reticular activating system in the brainstem is responsible for maintaining appropriate levels of arousal in the cortex as well as other specialized areas of the brain. And the subjective content (presumably, intracortical intercourse) of our experiences is dependent upon an individual's experience level, one's social-psychological conditioning, cognitive skills, and neurological development. I began to grasp an understanding of the power of Hemi-Sync.

The Hemi-Sync sound technology engenders the auditory sensation of binaural beating, and this rhythmic waveform can be objectively measured as a frequency-following response, providing evidence that it manifests within the brain.

Since this waveform is neurologically routed to the reticular formation and since the reticular activating system governs cortical brainwave amplitudes, Hemi-Sync binaural beats (through the mechanism of the reticular) thereby induce alterations in brainwave amplitudes or the arousal side of the consciousness equation. From this understanding, Hemi-Sync focus levels (Focus 10, Focus 12, etc.) become levels of brainwave arousal.

I have read numerous anecdotal reports of state changes (alterations in consciousness) encouraged by various low-frequency binaural beats. Listening to selected binaural beats seems to promote propitious states of consciousness in a variety of applications. It has been reported that binaural beating has different effects depending on the frequency of the binaural-beat stimulation.

I read that binaural beats in the delta (1 to 4 Hz) and theta (4

to 8 Hz) ranges are associated with reports of creativity, sensory integration, relaxed or meditative states, or as an aid to falling asleep. Binaural beats in the beta frequencies (typically 16 to 24 Hz) are associated with reports of increased concentration or alertness and enhanced-memory function.

Independent research has associated Hemi-Sync with changes in arousal leading to sensory integration, alpha biofeedback, relaxation, meditation, stress reduction, and pain management. I have read research reports linking Hemi-Sync with improved sleep, health care, enriched learning environments, enhanced memory, creativity, treatment of children with developmental disabilities, the facilitation of attention, and so-called peak experiences.

Further research validates Hemi-Sync's use in the enhancement of hypnotizability, treatment of alcoholic depression, the promotion of vigilance, performance and mood, increased intuition, improved reliability in remote viewing, telepathy, and out-of-body experience.

I found several free-running EEC studies that suggest that binaural beats may induce alterations in cortical arousal (ongoing brainwaves) and consciousness states. But I needed to do my own research. The only way I would know for sure how Hemi-Sync works was to find out for myself—something Bob Monroe had insisted on years ago.

Hemi-Sync and Brainwave Arousal

I decided to do two free-running EEC studies.²⁰ In the first study, I measured the neural accommodation (changes in ongoing or overall brainwave activity) associated with complex binaural-beat stimuli. In the second study, based on the same protocol, I measured changes in ongoing brainwave activity associated with placebo stimuli. By comparing the results of these two studies, I hoped to be able to validate the power of Hemi-Sync to alter consciousness.

As before, you can flip forward a few pages and see what I found out.

The hypothesis in the first study was that listening to Hemi-Sync for several minutes would modify ongoing brainwave activity in the direction of the binaural beat stimuli. That is, increasing the amplitude of delta-frequency binaural-beat stimuli while decreasing the amplitude of alpha-frequency binaural-beat stimuli would result in comparable changes in arousal as measured by free-running EEC.

I wanted to mimic existing, commercially available Hemi-Sync recordings, so the experimental binaural-beat stimuli consisted of mixed sinusoidal tones producing complex frequency patterns (waveforms) changing over a period of forty-five minutes. I first recorded brainwaves during a no-stimulus baseline condition. Next, I recorded brainwaves for each subject during six periods for the forty-five-minute sequence of changing binaural beats condition. Finally, I made an EEC recording during a no-stimulus post-baseline condition (figure 1).

I rejected the data from two of the subjects due to excessive movement artifact and used the remaining eighteen subjects' records for analysis. To determine statistical validity of the data, I

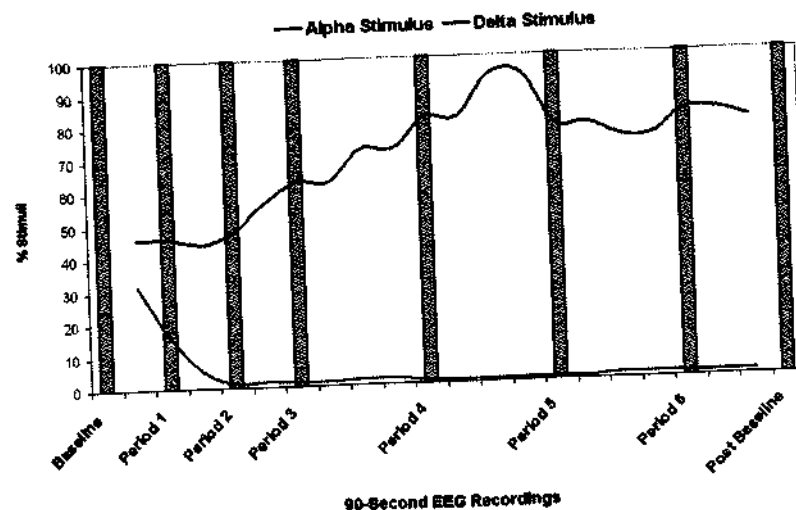


Figure 1

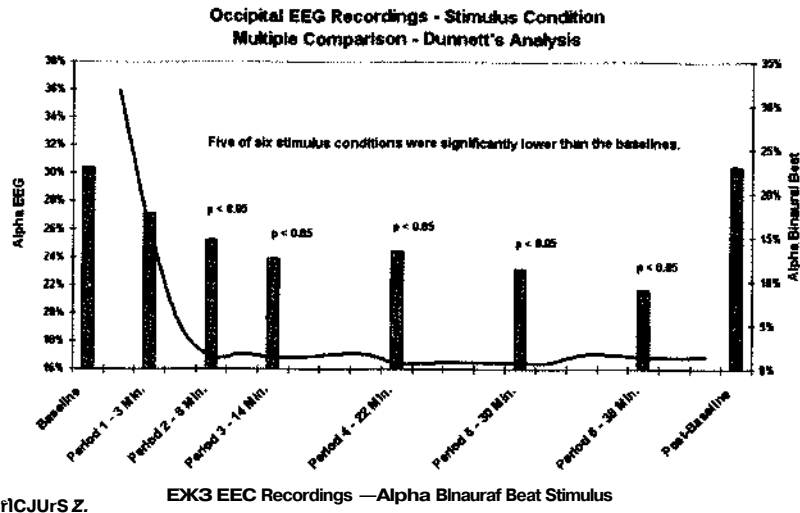


FIGURE 2.

EXK3 EEG Recordings — Alpha Binaural Beat Stimulus

conducted a multiple comparison procedure following a one-way analysis of variance (ANOVA), Dunnett's Test, which compared the combined baselines (before and after) as a control mean with the binaural-beat stimulus periods. This analysis showed the reductions in the percentages of occipital alpha during stimuli conditions were significant (individually, $p < .05$, and together, $p < .001$) during five of six stimulus periods compared to baselines (figure 2).

Statistical analysis of the data also showed the increases in the percentages of central delta during stimuli conditions were significant

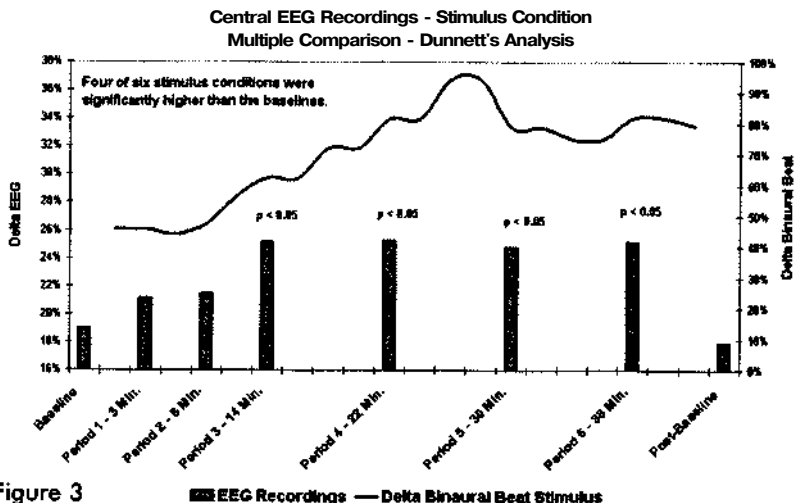


Figure 3

EEG Recordings — Delta Binaural Beat Stimulus

(individually, $p < .05$, and together, $p < .001$) during four of six stimulus periods compared to baselines (figure 3).

So, the results of this first study showed changes in brainwave activity during the stimulus periods when compared to the baseline recordings both with increased central delta and decreased occipital alpha. These decreases in alpha amplitudes, coupled with increasing delta activity, indicated reduced cortical arousal. The mounting changes over the time of the test and the course of the stimuli suggest a deepening trend of progressive relaxation and falling asleep.

A basic question raised by this first study was the role of Hemi-Sync stimulation in solely or directly causing the brainwave changes observed. Several of the subjects had had considerable previous experience with Hemi-Sync. Could it be that these subjects were naturally adept at altering levels of arousal or had acquired this ability through repeated Hemi-Sync practice? The deepening trend over time also suggests the need to take into consideration naturally occurring, progressive state changes associated with falling asleep. I designed a second study to address these concerns.

The hypothesis of the second study was that listening to monotonous tones (a placebo stimuli without binaural beats) for several minutes would result in habituation of the stimuli and a slowing of ongoing brainwave activity and a progressive state of relaxation.

The placebo stimuli consisted of the same sinusoidal tones used in the first study, except that they did not produce binaural beating. As in the first study, the volunteer subjects experienced a no-stimulus baseline condition during which a ninety-second EEG recording was taken. Next, each one listened to the same forty-five-minute sequence of changing tones during which six 90-second EEG recordings were taken at regular intervals. To reduce the influence of expectation, subjects were again blind as to the character of the tones. Finally, during a no-stimulus post-baseline condition, a ninety-second EEG recording was made.

A multiple comparison procedure following a one-way ANOVA (Dunnett's Test) comparing the combined baselines

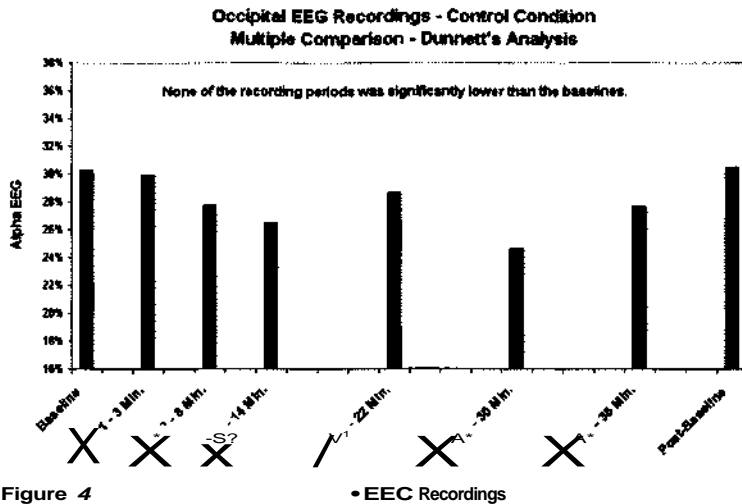


Figure 4 as a control mean with the placebo stimuli periods showed nonsignificant reductions in the percentages of occipital alpha during stimuli conditions compared to baselines (figure 4).

Statistical analysis showed the nonsignificant increases in the percentages of central delta during stimuli conditions compared to baselines (figure 5). The results of this second study, unlike the first, did not significantly distinguish occipital alpha and central delta brainwave activity during the placebo stimulus periods from the baselines.

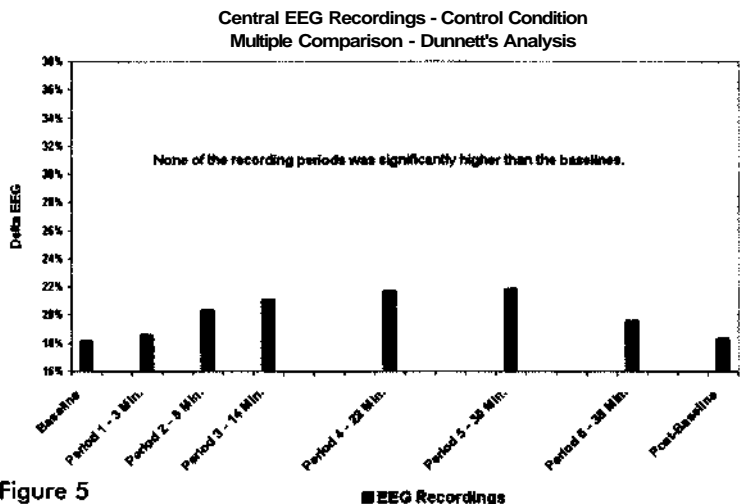


Figure 5

The hypothesis of this placebo study expected observed decreases in alpha amplitudes coupled with increasing delta activity as a reaction to listening to monotonous tones. These changes, however, were not statistically significant, meaning that they could be expected to have happened by chance alone.

Meaningful Results

Together, these studies demonstrate that Hemi-Sync has a direct effect on brainwave activity, involving the interaction of binaural-beat stimulation with the basic rest-activity cycle, other sensory stimulation, and higher-order memory or attentional processes under the scrutiny of the reticular formation. All of these systems cooperate to maintain our homeostasis and optimal performance.

Our natural state-changing mechanisms, ultradian rhythms, individual differences, prior experience, and beliefs all contribute to the effects of and response to Hemi-Sync. But for me the bottom line, so to speak, was that these two studies provided statistical observations demonstrating changes in cortical arousal in response to Hemi-Sync. *I* had my proof.

Ever since my adventure "through the Flavor Straw," *I* had been wondering how Hemi-Sync worked. These studies showed me that the power of Hemi-Sync to provide an environment conducive to personal explorations beyond our physical senses was real, not snake oil, or self-fulfilling prophecy, or just wishful thinking, but real—real, that is, at least in terms of modern neurology.

But did this mean that the binaural beats of the Hemi-Sync process constituted an irresistible force that could really put the *whammy* on you, so to speak? No! And *I* think Bob Monroe explained it best:

Hemi-Sync is like music. Imagine yourself out for an evening for dinner and dance. There you are, sitting at your table, having a cocktail, when the band strikes up a tune. Observing the couples around you, you see that some are getting up to dance, while others remain engrossed in their intimate conversations.

You notice that you are tapping your foot to the beat of the music and your companion has stopped talking and is listening intently to the familiar tune. The waiter suddenly appears, and your attention and response to the music fall away as you focus your attention on savory menu items.

What this all means is that music, like Hemi-Sync, only provides an inviting environment conducive to shifting your experience. The band music did not force or compel couples to dance. And Hemi-Sync cannot force or compel you in any way. Only you can change you. Your response to Hemi-Sync depends on you. If you willingly participate with the music, your experiences will be limited only by your own skill, expectations, and beliefs.

So was it Hemi-Sync that made my experience "through the Flavor Straw" back in 1977 possible? Or was it, as Bob had told me back then, that my experience was the result of my metaphysical upbringing and my intent? The answer to both questions is yes. Listening to Hemi-Sync apparently has the advantage of altering brainwave arousal, but one's subjective or cognitive experience of this shift is dependent upon one's beliefs, social-psychological conditioning, mental abilities or skills, intent, and perhaps even one's personal spiritual path or agenda.