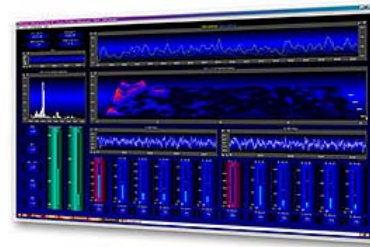
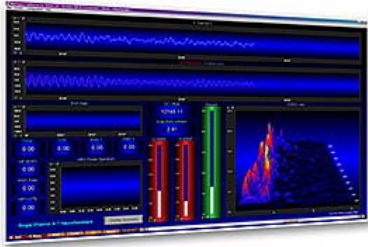


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## Alpha-theta synchrony Protocol – Frequently Asked Questions

“Damn it, Jim, I’m a doctor not a statistician.”  
- Dr. McCoy (“Bones”) - Starship Enterprise.



- Q: Why do you have a disclaimer?
- Q: When is alpha theta training performed?
- Q: What are the different ways people do alpha-theta work?
- Q: Why do you call your approach alpha-theta synchrony?
- Q: Is it safe to encourage theta, especially frontal theta?
- Q: Is there any experimental proof of the utility of alpha-theta work?
- Q: Can I use headphones or wireless headphones for audio feedback?
- Q: Should I leave the client alone during alpha-theta neurofeedback?
- Q: What are abreactions that occur with alpha theta protocols?
- Q: How can I manage bad reactions from alpha theta training?
- Q: How should I prepare my clients for alpha-theta neurofeedback?
- Q: What type of record taking is appropriate for alpha-theta neurofeedback?
- Q: What other types of biofeedback or neurofeedback work well with alpha theta protocol?
- Q: How does 2 channel work encourage synchrony?
- Q: Why are there peripheral physiologic instruments on your alpha theta screens?
- Q: Why are there both single channel and dual channel screens in your package?

Because this FAQ is provided primarily for Nexus users, reference will be made to the Nexus color of the various electrodes (e.g., white for ground, black for reference, red for exploratory electrode.)

### **Q: Why do you have a disclaimer?**

**A:** Neurofeedback is a relatively new discipline with a great capacity not only to help clients but to also provide practical applications to neuroscience. The range of people using neurofeedback equipment encompasses compassionate clinicians, skilled researchers, and unfortunately some profiteers. In order for our field to enjoy continued progress and ensure quality services to our clients, bio- and neurofeedback, as a form of applied psychophysiology, will need to re-organize itself with the help of state agencies.

Currently biofeedback gear is FDA approved for relaxation and education. If you have a license to treat physical or psychological complaints then you already know how important relaxation and self-awareness are to well-being. You are qualified to use these techniques within your scope of practice

to benefit your clients. You are also, hopefully, certified by the Biofeedback Certification Institute of America, and abide by their ethical guidelines. Thus it is expected that you will notify your client in writing of the experimental nature of neurofeedback.

My disclaimer is to notify you that an alpha-theta protocol using Fz and Pz has not been evaluated other than my own observations. Alpha-theta training at O1 (Peniston protocol) has been peer reviewed since 1989. P3-A1 / P4-A2 and even Pz have been used and taught extensively at seminars for nearly as long. The alpha synchrony component has been used successfully by Les Fehmi for nearly as long. The screen design available from my website can be used for 2 channel P3/P4 training as well. It has the advantage of simultaneous measurement of peripheral measures and multiple inhibits.

My disclaimer is to also affirm that the software screens and manuals I provide are not designed or offered for the diagnosis or treatment of any disease or condition. They are offered as is with no warranties regarding clinical outcome. If you elect to use these products with clients then you do so at your own risk and with full responsibility for any outcome. By installing the screens and channel sets on your computer you agree to use these products in accordance with your legal scope of practice.

**Q: When is alpha theta training performed?**

**A:** Alpha theta neurofeedback training has most often been suggested when there is evidence of trauma, posttraumatic stress disorder (PTSD), addiction ( either to substances or to one's own personality ), learned habits, fears, or when creative flexibility is desired. Research also suggests that alpha-theta training may be indicated in cases of excess frontal fast activity, poor autonomic control, excess introversion, neuroticism, and disturbed default mode network status. Some types of ADHD may benefit from alpha theta training.

**Q: What are the different ways people do alpha-theta work?**

**A:** Different practitioners do neurofeedback differently depending upon their clinical licenses and goals. Early work, such as that of Peniston, used a single channel with the exploratory (red) lead on O1. Both alpha and theta were rewarded. Later work, such as that of the Othmers, used 2 channels with exploratory leads on P3 and P4; both alpha and theta were rewarded. John Anderson uses a single channel with the exploratory lead on Pz and rewards a band centered on 7 Hz (sometimes called "Thalpa"). When rewarding alpha and theta individually, many practitioners will use one sound for theta and a different sound for alpha. The volume of the sound may be proportional to the amplitude of the reward bands. It is not uncommon for gongs or chimes to sound, indicating a specified time above threshold. John Anderson's setup is certainly the easiest. He uses sound which is proportional to the amplitude of his single 5.5-8.5 Hz reward band. The client learns to increase the volume by increasing the amplitude of Thalpa at Pz.

Most practitioners believe that when the amplitude of theta crosses over (exceeds) the amplitude of alpha, the client will have access to deeper memories or significant visualizations. This point is called alpha-theta crossover. Moore, et al, in 2000, provided evidence suggesting that the crossover was not related to any enhanced visualizations.<sup>1</sup> I agree. I find no predictive validity in the so-called crossover. Whenever possible I ask my clients to narrate their inner states during a session. I often find that moments before an "ah-hah!" experience there will be a synchronous burst of alpha and theta, followed for a few seconds by heightened beta activity and terminated by a brief gamma burst.

Over the last year I modified the standard approaches to alpha theta training. This modified approach may perhaps be best referred to as "alpha theta synchrony training".

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<sup>1</sup> Moore JP, et al. Comparison of alpha-theta, alpha and EMG neurofeedback in the production of alpha-theta crossover and the occurrence of visualizations. Journal of Neurotherapy, Vol 04 No 1, 2000.

## Q. Why do you call your approach alpha-theta synchrony? How did it start?

A: I use a 2 channel summed montage, up-training both alpha and theta at Fz and Pz, rewarding for increased synchrony between Fz and Pz, and employing multiple inhibits. For the theta feedback sound I use 37.5 Hz in the left ear and 42.5 Hz in the right ear to gently entrain 5 Hz theta in the auditory cortex.

This is not the place to discuss in detail how and why I developed this approach. But I will discuss briefly the 6 main issues that influenced me.

1. The importance of frontal midline theta
2. fMRI and EEG studies of meditative and peak states
3. Default mode networks
4. Role of the precuneus (BA 7)
5. Role of anterior cingulate (BA 24) in neuropsychiatry.
6. The usefulness of multiple inhibits

Frontal Midline Theta (Cigánek rhythm). Unlike the polymorphic theta that is associated with inattentiveness, the Cigánek rhythm occurs during concentration as well as drowsiness<sup>2</sup>. The frontal midline theta described in the literature is associated with beneficial psychological and regulatory states, namely, decreased neuroticism, better autonomic control, increased outgoingness, positive mental state, and immersive-meditative states. (more below).

Meditative and peak states research: Mario Beauregard's recent fMRI work with Carmelite nuns during the "mystical" state found increased theta in the anterior cingulate cortex (BA 24) and superior parietal lobule (BA 7).<sup>3</sup> Brodmann areas 24 and 7, correspond to Fz and Pz. Several studies have emphasized that meditation leads to periods of alpha and theta coherence lasting over 40 seconds, more evident frontally, and correlated to the clarity of the experience<sup>4</sup>. Strong and sustained alpha coherence during meditation distinguishes this state from the loss of alpha coherence that occurs with sleepiness<sup>5</sup>.

Default mode networks: Raichle, et al, in 2001 elucidated a "default mode" of brain functioning<sup>6</sup> in healthy individuals at rest. Certain types of non self-referential mental activity cause a reliable deactivation in key areas including medial prefrontal cortex, anterior cingulate and precuneus (see figure below from Raichle). These deactivations may be able to be reactivated toward normal default mode status through neurofeedback, particularly at Pz and Fz.

The following figure, taken from Raichle, et al 2001, shows horizontal slices through the cortex and areas that are maximally deactivated during deviations from the normal default mode. Note the prominence of the medial orbitofrontal areas, the precuneus, and the anterior cingulate.

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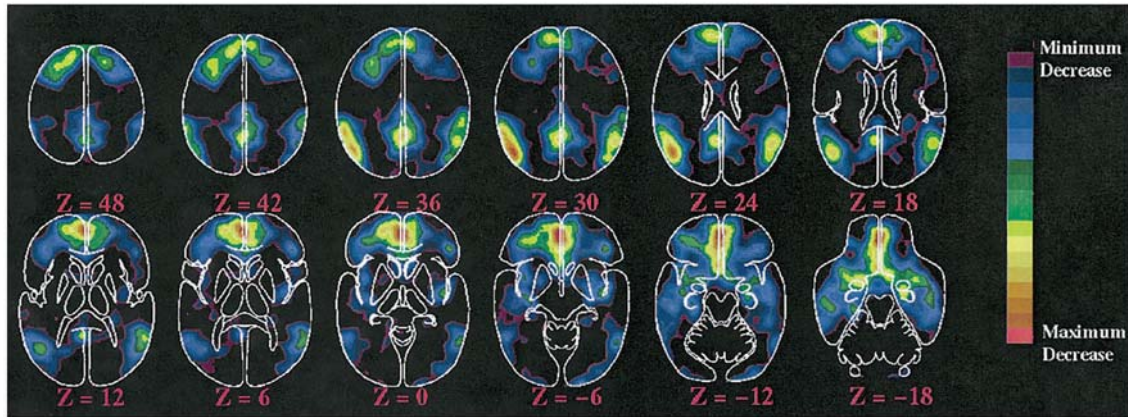
<sup>2</sup> Stern JM & Engel J. Atlas of EEG Patterns. Lippincott Williams & Williams, Philadelphia PA. 2005, p 270.

<sup>3</sup> Beauregard M & O'Leary D. The Spiritual Brain. HarperCollins, NY, 2008. P 275.

<sup>4</sup> Badawi K, et al. Electrophysiologic characteristics of respiratory suspension periods occurring during the practice of the transcendental meditation program. Psychosomatic Medicine 1984; 46:267-276

<sup>5</sup> Levine P. The coherence spectral array (COSPAR) and its application to the study of spatial ordering in the EEG. Proceedings of the San Diego Biomedical Symposia 1976; 15:2337-247.

<sup>6</sup> Raichle ME, et al. A default mode of brain function. Proc. Natl. Acad. Sci. 98,2, 676-682.



Role of the precuneus: Cavanna AE, et al, in 2006, state: “Recent functional imaging studies in healthy individuals suggest a central role for the precuneus in a wide spectrum of highly integrated tasks, including visuo-spatial imagery, episodic memory retrieval and self-processing operations, namely first-person perspective taking and an experience of agency. Furthermore, precuneus and surrounding posteromedial areas are amongst the brain structures displaying the highest resting metabolic rates (hot spots) and are characterized by transient decreases in the tonic activity during engagement in non-self-referential goal-directed actions (default mode of brain function).”<sup>7</sup>

Role of anterior cingulate (AC) in neuropsychiatry: “It has been demonstrated that humans can acquire a certain degree of control over the electrical activity of their own AC.”<sup>8</sup>

Patients with post traumatic stress disorder (PTSD) characterized by inability to repress traumatic memories, showed reduced activity of the rostral anterior cingulate compared with controls.<sup>9</sup>

“Anterior cingulate cortex volume is substantially smaller in association with combat-related PTSD, a finding broadly consistent with cingulate hypofunctionality in that disorder.”<sup>10</sup>

Referring to the subgenual cingulate, Brodmann area 25, also known as “Cg25”, Carhart-Harris, et al, state “...Cg25 exerts a controlling influence over visceromotor regions.” “...Cg25 is centrally involved in repression.” “...sudden lifting of negative affect upon stimulation of Cg25 is consistent with the idea of a release of libido for object cathexis after it has been pathologically dammed up behind a repressing central force.” “...inhibiting activity in Cg25 facilitates the disintegration of a wider network. For example, it is possible that activation of Cg25 supports activation of the DMN (Default Mode Network).”<sup>11</sup>

<sup>7</sup> Cavanna AE, et al. The precuneus: a review of its functional anatomy and behavioural correlates. *Brain* (2006), 120, 564-583.

<sup>8</sup> Cannon R, et al. The effects of neurofeedback training in the cognitive division of the anterior cingulate gyrus. *Intern. J. Neuroscience*, 117:1–22, 2007.

<sup>9</sup> Britton JC, Phan KL, Taylor SF, Fig LM, Liberzon I: Corticolimbic blood flow in posttraumatic stress disorder during script-driven imagery. *Biol Psychiatry* 2005, 57:832-840.

<sup>10</sup> Woodward S, et al. Decreased anterior cingulate volume in combat-related PTSD. *Biological Psychiatry*, vol. 59, num 7, 2006, p 582-587.

<sup>11</sup> Carhart-Harris RL, et al. Mourning and melancholia revisited: correspondences between principles of Freudian metapsychology and empirical findings in neuropsychiatry. *Annals of Gen Psychiatry* 2008, 7:9.

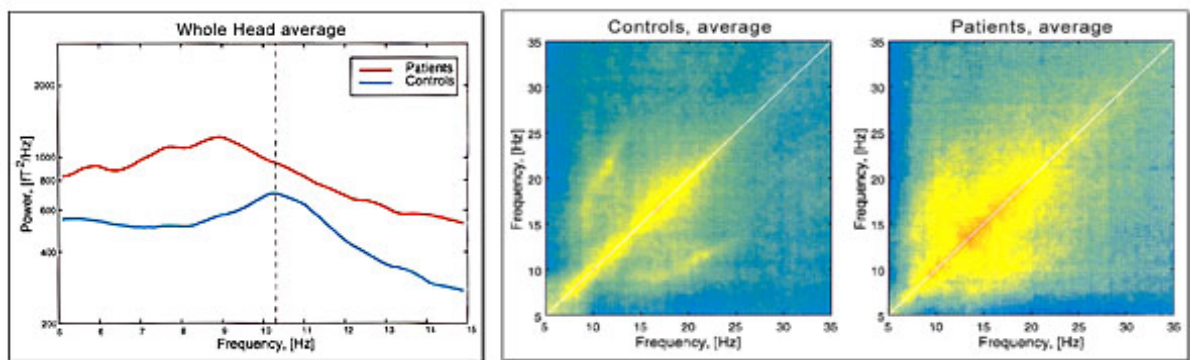
“our findings suggest that the long-range connections linking dorsal anterior cingulate to posterior cingulate and precuneus should be considered as a candidate locus of dysfunction in ADHD.”<sup>12</sup>

The usefulness of multiple inhibits: The nature and purpose of multiple inhibits are often misunderstood. The following paragraph is a description taken from the alpha-theta protocol guide that accompanies the screen and channel sets.

“In traditional amplitude training, it is common to have a “high inhibit” instrument to discourage excessive beta activity or EMG activity. Suppose you have a high inhibit which is set for the range of 15-30 Hz. You observe that your client has 20 Hz activity that is usually above 5 microvolts but occasionally above 10 microvolts. You could set an alarm threshold so that any signal above 10 microvolts between 15 and 30 Hz gives a warning signal. However, your client may also have a repeated 4 microvolt activity at some other frequency, say 28 Hz, that is more clinically significant. Unfortunately, it will not trigger the “high inhibit” because the high inhibit is set to 10 microvolts across the entire 15-30 Hz range. Unfortunately, in order to capture the 28 Hz 4 microvolt signal, you can’t just lower the general 15-30 Hz threshold from 10 microvolts down to 4 microvolts because the 20 Hz signal is usually above 5 microvolts and would set off the alarm all the time.”

“One way to capture more rogue excursions is to have multiple inhibit bins, each spanning 4 Hz. For example, you could have an 18-22 Hz bin, a 22-26 Hz bin, and a 26-30 Hz bin. The 18-22 Hz bin could have a threshold of 10 microvolts to catch its rogue excursions, and the 26-30 Hz bin could have a threshold of 4 microvolts to catch its rogue excursions as well.”

In Llinas' 1999 article on thalamocortical dysrhythmia<sup>13</sup> he reports observations on clients with a variety of conditions including neurogenic pain, depression, tinnitus, epilepsy, obsessive-compulsive disease, dystonia and spasticity. In general he found increased cortical power expenditure across the entire spectrum in patients compared to controls. Patients also showed excessive hypercoherence across all frequencies compared to controls. These relationships are shown in the chart (after Llinás) below.



Excess cortical power of patients vs controls (Left); Normal coherence 5-35 Hz in controls (Mid); Hypercoherence 5-35 Hz in patients (Right).

<sup>12</sup> Castellanos FX, et al. Cingulate-precuneus interactions: a new locus of dysfunction in adult attention-deficit/hyperactivity disorder. *Biol Psychiatry*. 2008; Feb 1;63(3):332-7.

<sup>13</sup> 3. Llinas R. Thalamocortical dysrhythmia: A neurological and neuropsychiatric syndrome characterized by magnetoencephalography. *Proc. Natl. Acad. Sci.* 96, 15222-15227.

The graphs on the right in the above figure (taken from Llinás, 1999) show the hypercoherence across all frequencies that is common in most default network problems. Any concerns about the possibility of increasing coherence problems through alpha-theta synchrony training at Fz – Pz can be addressed by preparatory single channel bipolar training as utilized by Othmers, et al.

**Q: Is it safe to encourage theta, especially frontal theta?**

A: There is a more complete discussion of the effects of alpha-theta training on my pages dealing with PTSD and with music and creativity ([www.growing.com/mind](http://www.growing.com/mind)).

Alpha theta training reduces frontal fast beta activity such as is seen in PTSD, stage fright, and pain.<sup>14</sup> Such fast beta activity may predict relapse in those being treated for chemical dependency.<sup>15</sup>

Alpha theta training enhances fronto-central theta (rhythmic not polymorphic) which is associated with focused attention, immersive-meditative concentration, creative performance and working memory tasks, and emotionally positive state.<sup>16</sup>

Enhanced frontal theta activity has been associated with feelings of well-being, relief from anxiety, and reduced activation of the sympathetic (fight or flight) nervous system.<sup>17</sup>

Enhanced frontal theta activity under task improves regulation of autonomic function, especially cardiac autonomic function.<sup>18</sup>

Appearance of fronto-central theta rhythm is related to positive personality traits; these traits include lower score on anxiety and neuroticism scales and higher scores on an extraversion scale.<sup>19</sup>

**Q: Is there any experimental proof of the utility of alpha-theta work?**

A: Peniston has published impressive studies of the effectiveness of alpha theta neurofeedback with addiction<sup>20</sup>; Eigner and Gruzelier<sup>21</sup> have done studies showing the benefits of alpha theta protocols in creativity. Susan Othmer has an 8 DVD session-by-session recording of a disabled Bosnian veteran

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<sup>14</sup> Egner T, Zech TF, Gruzelier JH. The effects of neurofeedback training on the spectral topography of the electroencephalogram. Clin Neurophysiol. 2004 Nov;115(11):2452-60.

<sup>15</sup> Bauer LO. Predicting relapse to alcohol and drug abuse via quantitative electroencephalography. Neuropsychopharmacology, 2001; 3:332-340.

<sup>16</sup> Aftanas LI, Golocheikine SA. Human anterior and frontal midline theta and lower alpha reflect emotionally positive state and internalized attention: high-resolution EEG investigation of meditation. Neurosci Lett. 2001 Sep 7;310(1):57-60.

<sup>17</sup> Mizuki Y, Hashimoto M, Tanaka T, Inanaga K, Tanaka M. A new physiological tool for assessing anxiolytic effects in humans: frontal midline theta activity. Psychopharmacology (Berl). 1983;80(4):311-4.

<sup>18</sup> Kubota Y, Sato W, Toichi M, Murai T, Okada T, Hayashi A, Sengoku A. Frontal midline theta rhythm is correlated with cardiac autonomic activities during the performance of an attention demanding meditation procedure. Brain Res Cogn Brain Res. 2001 Apr;11(2):281-7.

<sup>19</sup> Mizuki Y, Kajimura N, Nishikori S, Imaizumi J, Yamada M. Appearance of frontal midline theta rhythm and personality traits. Folia Psychiatr Neurol Jpn. 1984;38(4):451-8

<sup>20</sup> Peniston EG & Kulkosky PJ. Alpha-theta brainwave training and beta-endorphin levels in alcoholics. Alcoholism, Clinical and Experimental Research, 13(2), 271-279.

<sup>21</sup> Egner T & Gruzelier JH. Ecological validity of neurofeedback: modulation of slow wave EEG enhances musical performance. Neuroreport. 2003 Jul 1;14(9):1221-4.

responding well to alpha theta neurofeedback.<sup>22</sup> Recent research has replicated the 1989 Peniston & Kulkosky work.<sup>23</sup>

**Q: Can I use headphones or wireless headphones for audio feedback?**

A: I use 37.5 Hz in the left ear and 42.5 Hz in the right ear. In order to gently entrain the auditory cortex, the frequency applied to the left ear must not reach the right ear ( and vice versa ). Thus headphones must be used, in order to keep the audio isolated. Because the central audio frequency is 40Hz, headphones with high quality bass response are required. Typical low- and mid-range headphones can not reproduce this low frequency.

Many headphones plugged into a desktop computer can pickup 60 Hz contamination and couple it to the EEG leads. I have had good results with Sony MDR-V6 headphones. They are about \$80.00. They have excellent frequency response and are delightful for music or low-frequency audio. They seem to be well shielded and I have no problems with them coupling ambient 60 Hz contamination to the EEG leads.

I prefer wireless headphones. Most of the ones I tried did not work well. The main headphone I use now is a wireless Acoustic Research model AWD210. It does not add 60 Hz contamination and it has a volume control on the headphone itself so that the client can adjust it for comfort. In addition, the headphones have ear pieces sufficiently large that, even though they are not noise blocking headphones, the client does not hear much of the ambient noise, allowing me to take notes on my computer when a client narrates during the session.

I have audio splitters on all my biofeedback computers. These \$5 adaptors from Radio Shack allow me to plug in two pairs of headphones. That way I can listen to the same audio as my client. It is important to listen to the audio and make certain that it is conveying both alpha and theta sounds clearly.

**Q: Should I leave the client alone during alpha-theta neurofeedback?**

A: I have seen luminaries in our field offer sleep masks, turn off the lights, and leave their shell-shocked clients in a dark room, attached to wires, with cars backfiring outside. Their sessions seemed to be quite successful. Perhaps they pre-screen their clients in ways that are not obvious. I could not do this. Perhaps my clients are different. My goal is not to find a better way to treat *their* clients, but rather a better way to treat mine.

I find that about half of my clients are willing to describe their personal inner experiences during the session. When my clients describe their experiences I note the time (from the Nexus elapsed time indicator) and the nature of the comments. These notes can be very important for debriefing afterwards.

**Q: What are abreactions that occur with alpha theta protocols?**

A: "Bad reactions" can happen with any type of neurofeedback. Falling back for a moment to our most common denominator of "biofeedback as a method for relaxation and educational purposes", we can say that anytime you enable someone to relax his or her defenses and regain forgotten sensations or memories, you can cause client distress. The real problem arises when the practitioner is not confident, capable, and compassionate.

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<sup>22</sup> [www.eeginfo.com](http://www.eeginfo.com)

<sup>23</sup> Callaway TB, et al. Long-term follow-up of a clinical replication of the Peniston protocol for chemical dependency. Journal of Neurotherapy, Vol 12(4);2008:243-259.

If you are doing this work specifically to recover memories or to aid therapy, then you must work within the scope of your clinical license. When I first started learning neurofeedback I was astonished at the reluctance many practitioners had toward using alpha theta techniques. If you are not already comfortable dealing with PTSD, abuse, and torture *without* using alpha theta neurofeedback, then you will not be comfortable using it either. You are on safer ground using it for enhancement of creativity and well-being in psychologically healthy people. But even psychological health is a concept often relative to the moment. I have had long-time psychotherapists, who supposedly had many years of their own therapy, become nearly hysterical with grief when they suddenly realized that a current difficulty in their lives was really an attempt to avoid facing an overwhelming childhood grief or abandonment.

I am very pleased that our Nexus alpha theta synchrony screens offer something I have not seen elsewhere, namely, the ability to monitor important peripherals during the session. You can get important functional information and early indication of autonomic arousal by watching heart rate variability power spectrum, electrodermal response, and finger temperature during your sessions.

**Q: How can I manage bad reactions from alpha theta training?**

A: I hesitate to call any reactions “bad”. Certainly, if a therapist pushes a client beyond his or her limit, or is condescending or dismissive, trouble can start. The best way to “manage” reactions is to see them coming. Please see my section on PTSD elsewhere on my website for a more complete discussion.

A client can deny trauma yet still be suffering from pre-verbal trauma, inadequate anesthesia during surgery, or such widespread socially tolerated traumas as humiliation or sexualization by relatives, teachers and peers at schools. Clients will often have a window of tolerance in which they typically function at a disadvantage. As clients’ states change during bio- or neurofeedback, they may be pushed out of their window of tolerance and into over- or under-arousal or instability. Peripheral biofeedback instruments may detect and suggest this development. However, the best instrument is your careful attention to your client’s complete presentation, i.e., body language, tone of voice, interaction, state of mind, breathing patterns, etc..

If a client shows signs of over arousal, under arousal, instability or dissociation, you can pause the training and bring the client’s attention back to the present. This is an advanced topic suitable primarily for licensed practitioners.<sup>24, 25</sup> Mirroring the client, or at least debriefing the client after the session, accompanied with your own attitudes of “curiosity, openness, acceptance, and appreciation” is a powerful adjunct. After all, these are the same attitudes your clients will use in order to discover that they are more than their mere thoughts and reactions.

If during or after an alpha theta session your client experiences, for example, discomfort that is emotional, physical or cognitive, then there are specific low-frequency single channel bipolar techniques which are often useful. Those are discussed in the Nexus low frequency protocol elsewhere on this website.

**Q: How should I prepare my clients for alpha-theta neurofeedback?**

A: Peniston had clients train with temperature for a number of sessions to foster relaxation and familiarity with biofeedback and self-regulation. Then, before the alpha theta sessions, he had them

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<sup>24</sup> Ogden P, et al. Trauma and the Body: A Sensorimotor Approach to Psychotherapy. WW Norton, NY, 2006.

<sup>25</sup> Levine PA. Waking the Tiger – Healing Trauma. North Atlantic Books, Berkeley, CA. 1997.

imagine a script which they had developed together. In the script the client imagines successful behavior and relationships, and imagines avoiding addictive or destructive behavior.

Sue Othmer often does low frequency training before alpha theta in order to reduce issues of arousal and instability.

Other practitioners, myself included, also like to do heart rate variability training and train diaphragmatic breathing before starting alpha theta training. Takahashi et al showed that frontal alpha and theta power were associated with HRV power spectrum.<sup>26</sup>

**Q: What type of record taking is appropriate for alpha-theta neurofeedback?**

A: The medico-legal standards in your field will partly determine the answer. Certainly basic session parameters and client response should be logged. In some cases my clients talk out loud and describe their feelings and visualizations during the session. If they have good headphones on, they are not bothered by my typing of their notes at the computer. It is often useful to have the client keep a journal, at least to note any changes in arousal, sleep, dreams, appetite, cravings, mood, relationship difficulties, performance, etc. In peak performance training it is particularly useful to design a questionnaire which uses analogue Likert items. If your client's performance can be objectively rated between NF sessions it is often helpful to have access to the scores.

**Q: What other types of biofeedback or neurofeedback work well with alpha theta protocol?**

A: Peniston used temperature training for several sessions before starting neurofeedback. Many practitioners use heart rate variability training before and during the alpha theta training. Those who use the low frequency bipolar protocol as taught by the Othmers often start with low frequency training to deal with issues of arousal and instability. They are also likely to return to brief low frequency bipolar sessions at various 10-20 locations to take care of any disturbances that arise during the alpha theta training. Of course, there may be additional issues in your client's presentation that would suggest additional evaluation, e.g., qeeg, and neurotherapy.

**Q: How does 2 channel work encourage synchrony?**

A: 2 channel neurofeedback usually operates in one of at least 4 different modes. Each red exploratory electrode can have its black reference lead on an electrically silent area such as the ear lobe. The ground is placed in a convenient location. 1) each channel can train amplitude of a selected band in its own 10-20 location; or 2) one can train on the coherence between the two sites; or 3) one can train on the sum of the amplitudes at the two exploratory electrodes, or 4) one can train on the difference between the amplitudes at the two exploratory electrodes. The last montage, 2 channel "difference" training functions like a single channel bipolar montage, i.e., the reward instrument amplitude increases as the two signals become more different. The 3<sup>rd</sup> montage mentioned above, "summation training" works the opposite of "difference training". Summation training rewards the client when the activity under the two red electrodes becomes more similar and more synchronous.

**Q: Why are there peripheral physiologic instruments on your alpha theta screens?**

A: The earliest biofeedback devices had suitcase sized units for every modality. It has only been relatively recently that circuit design and manufacturing has enabled a small book sized device to

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<sup>26</sup> Takahashi T, et al. Changes in EEG and autonomic nervous activity during meditation and their association with personality traits. International J of Psychophysiology 55 (2005) 199-207

have wide-band stability and accuracy in the measurement of all major modalities simultaneously. Developments in software design and operating systems, as well as computer interfaces such as USB, optical, and Bluetooth, have all contributed to convenient, comprehensive and flexible instrumentation.

By monitoring such peripheral measurements as heart rate variability power spectrum, electrodermal skin response, finger temperature, and respiratory rate along with EEG, you have a sophisticated physiology lab. You can often tell when a client is becoming anxious, or over- or under-aroused by observing the peripherals. This gives you the chance to interact with the client and perhaps modify your session. You may be able to obtain information about which physiologic system is most reactive to stress and include that knowledge in your treatment plan.

**Q: Why are there both single channel and dual channel screens in your package?**

**A:** The included single channel module uses the “default channel set”. This means that if during a session you are using other screens that use the default channel set, you can switch to this screen and do standard single channel referential neurofeedback on a single location, e.g., O1 or Pz, and reward “thalpha” (5.5-8.5 Hz). This is a simple, often effective technique, that can be smoothly integrated into your other default channel work. However, clearly it addresses one frequency band at one location, and does not address connectivity or use multiple inhibits. This is the sort of screen used in the approach taught in introductory neurofeedback classes. Our single channel screen does have the advantage that it includes peripheral measures such as heart rate variability and EDR.

The dual channel screen included with the Nexus Alpha-Theta Synchrony protocol allows you to choose two sites (consider Fz and Pz or P3 and P4), train two bands (alpha and theta), support synchrony (the channels are summed), and incorporate multiple inhibits (to reduce dysrhythmia and approximate the default mode network state.)