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Live Complexity Training - LCT

LCTx2 (Dual Channel) for Nexus BioTrace+

Including Theta Alpha Gamma Synchrony

TAG Sync x2

Rev 3, June 2020

Operations - Introduction

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Preface

When I started studying neurofeedback in 2008 I was intrigued by the standard "alpha-theta" technique that had been so helpful in promoting self-regulation. This technique normally used a single electrode on the back of the head. It emphasized a state change marked by "theta-crossover". Theta amplitude crosses over (exceeds) alpha amplitude in the hypnogogic state before sleep. I envisioned a different type of alpha-theta regulation that promoted phase synchrony between Fz and Pz at two different frequencies. I called it alpha-theta synchrony. I believe it was the first explicit use of cross-frequency coupling in neurofeedback. I expected this type of self-regulation practice to be adaptogenic and promote valid perception, cognition and maturation/evolution rather than the hypnogogic drowsy state so useful before sleep.

When clients started learning alpha-theta synchrony it was clear that there was a simultaneous expression of global broad-band synchronization (**GBBS**) especially of theta, alpha and gamma activity. This led to the creation and distribution of Theta-Alpha-Gamma Synchrony – **TAG Sync** – starting in 2010. I predicted that sudden TAG Sync was the EEG signature of insight, in particular the insight that might appear in the space (bardo) between two thoughts (when fictitious narrative rumination relaxed and the "natural mind - Rigpa" appeared). Later TAG Sync was shown to be the signature of the near death experience (Borjigin et al 2013 PNAS).

I felt there was still a large piece missing from the theory behind these methods. I was also troubled by the fact that some individuals would initially respond well to the training but would end up days later with an aggravation (often autoimmune and/or neurocognitive) and a characteristic change in the EEG.

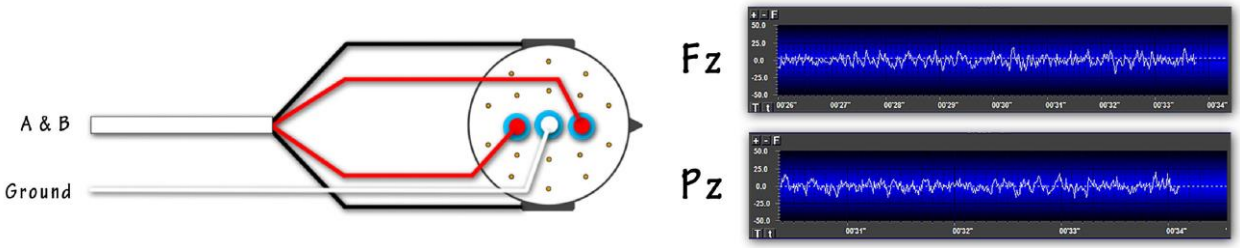
In 2015 I understood that synchrony was needed to harness the growth of complexity that comes with successful, adaptive maturation/evolution. I also observed that when individuals had a worsening after treatments it was because of the subsequent appearance of what I call **EEG sickness behavior**. I used a Kuramoto oscillator model (tagsync.com) to show and explain a continuum between an EEG or HRV signal that displayed complexity and one that displayed what I now recognize is canonical sickness behavior. Live Complexity Training (LCT) was created. It is now a simple but powerful way to categorize physiological signal behavior and use it to train recognition and change of states between wellness behavior (managed complexity) and sickness behavior (generally fast waves riding on slow waves with habitual redundancies, inefficiency and loss of complexity).

I have pointed out the use of EEG as a **transdiagnostic biomarker** of sickness behavior. Because we are not talking about one state versus another, but rather a trend in movement toward either extreme, we can appreciate the concept of the adaptogen. An **adaptogen** is also applied transdiagnostically and leads to more adaptive/skillful functioning with few or no side-effects. Good sleep is the prototypical adaptogen. Loss of sleep also moves the EEG toward sickness behavior.

It is my hope that Live Complexity Training (LCT) will continue to be investigated and that it will be able to support the evolution of theory and methods in both functional medicine and mindfulness/meditation practices. Our lives exhibit complexity. Shouldn't our EEGs?

Electrode Setup

Typically only two amplifier channels and two exploratory electrodes are used for LCT and TAG Sync. They can be placed anywhere on the scalp in order to train 1) *synchrony between* them as well as 2) efficient *complexity underneath* them. The most common sites are the midline anterior and posterior sites known as Fz and Pz in the front and the posterior of the midline of the scalp as shown below. They give the most reliable signal for detecting slight changes in the state of wakefulness and the availability of skillful means.



The two red electrodes are called "exploratory" electrodes. Each has a black electrode partner that is called a "reference" electrode. The Ground is shown connected to the vertex. I prefer to attach it below the sternal notch using a disposable adhesive electrode. There are other alternatives. The ear references *are* not linked together. The exploratory electrodes give us a recording of the electrical activity in the regions underneath and around each electrode. We will also be recording the synchrony between the two regions. In general Channel A is placed in front of and/or to the left of Channel B by convention. Your placement, of course, will reflect your intentions.

The instruments on the right in the above figure are called oscilloscopes. They show the "raw" EEG in each channel. Since the frequencies of interest are below 100 Cycles per Second (Hz) we can compare the back and forth pulsing of the electrical charges in the electrodes above with the physical back and forth pulsing that you can see and hear in the diaphragms of stereo speakers playing loud bass. There is a characteristic Cross-Frequency Coupling (CFC) between the low frequencies and the high frequencies that gives the brain a characteristic tone just as it gives musical instruments timbre.

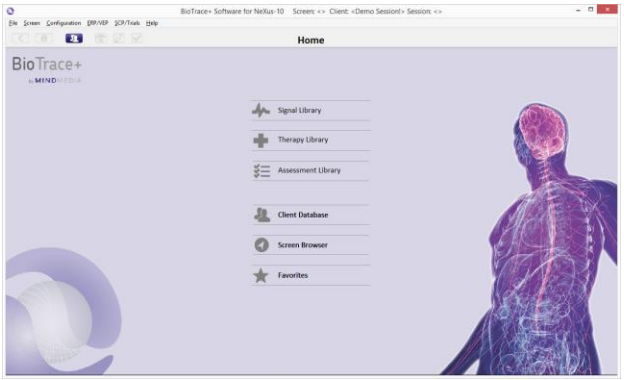
The head illustration above shows approximate locations only. In order to have your recordings be consistent please refer to the International 10-20 System of electrode placement. There are

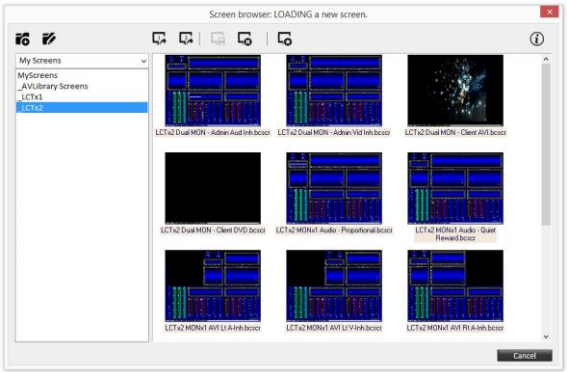
many other locations on the cortex and scalp that may be useful to examine and train, for example areas of trauma or areas with inefficient white matter connectivity. The most common sites for LCT and TAG Sync training are 1) midline anterior and posterior (Fz-Pz), 2) Right or left fronto-parietal networks (F3-P3 and F4-P4), 3) interhemispheric (e.g., F3-F4, C3-C4, P3-P4, etc.).

Introduction to the Screens

Your LCT screens for the Nexus can be found on your computer as follows:

To see that you screens are available start your BioTrace+ Application. The main menu appears as shown below on the left. Choose “Screen Browser” from the list, or simply press the “L” key to Load the Screen Library. It appears below on the right.





The names of the screens indicate their intended use. MONx1 means only a single monitor is used. Dual MON means a second monitor is used for client video file or DVD feedback. Either type of video will stop playing if the synchrony rewards fall below threshold. In the “Admin Vid Inh” screen the Video playback also stops when any inhibits exceed their thresholds. In the “Admin Aud Inh” screen an Audio alert is sounded when any inhibits exceed their thresholds. When using a single monitor that also displays either a video file (e.g., AVI) or the DVD, the trainer can choose which side of the screen the video is displayed on. With these MONx1 screens the Administrator can also decide whether to simply have the video also pause when inhibit bins are exceeded (V-Inh) or whether to supply an additional discreet audio alert (A-Inh).

In the screen browser left click to select the screen titled “LCTx2 MONx1 Audio - Quiet Reward”. Then at the top of the screen browser left click the tiny screen “1” icon to load this screen on the administrator’s monitor.

I introduced **Quiet Reward** in 2009 and have not found any other systems that have employed it. Other systems tend to shape physiological and behavioral responses by rewarding target EEG changes with an audio-visual cue such as increased volume or size of a DVD, or by a variety of

system sounds such as chimes or other MIDI sounds. In Quiet Reward the instruments and thresholds are adjusted so that when the trainee is slightly more awake, adaptive and/or balanced and graceful then the sounds of the software stop. The client is told not to listen to the system sounds anyway but to listen to the silence and increase its duration. The goal is to recognize certain state changes such as in rumination, tension, disconnection, irritability, and so forth.

This mindful discrimination of states is accompanied by following the raw EEG which takes 5 seconds to go from left to right before it is refreshed to the left side again. The breathing is then easily adjusted to six breaths per minute – five seconds in and five seconds out. This is also known as 0.1 Hz, a frequency produced by the cardiovascular system as well as the anterior cingulate in the frontal midline of the brain. Each breath should be fully diaphragmatic if possible. The posture should reflect mindfulness of our one-pointed relationship with gravity and the vertical. The client is instructed to move h-is/er attention to the top of his body near the completion of the inhalation and then scan down the body, arms and legs during exhalation. At each point in the scan we recognize any imbalance or unnecessary tension. The cycle repeats. Tendency to ruminate, drift off, or exhibit fast waves riding on slow waves (sickness behavior) will be preceded by system sounds. When we drop repetitive behaviors, become more awake and exhibit an increase in complexity then we are rewarded with silence. It is helpful to train with the eyes open. With the salience of silence both operator and trainer can recognize a change of state that is both subjective and objective.

This is all based on easily visible changes in both the raw visual signal (EEG in this case) as well as the digitally quantified and analyzed signal (qEEG in this case). This is discussed with supportive references at tagsync.com.

Three Fundamental Signals in Constructal Nature

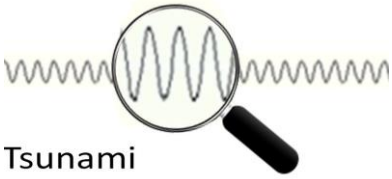
It is useful to consider three basic types of signals that can usually be easily classified by casual visual examination of the raw waveform as well from its digital quantification. I call these three waveforms 1) Sizzle, 2) Tsunami and 3) Sickness Behavior. I explain their origin using a Kuramoto oscillator model at tagysnc.com. Here is how they will look on your instruments

Sizzle appears random but is actually what is called pink noise, or 1/f noise. It is the hum of persistence and evolution in the sense of the Constructal Law of Physics. This is complexity. It is produced by Self-Organized Criticality (SOC) in and among the Small-World Networks (SWNs) of the macro- and micro-biome.

The body, speech, mind and EEG all move toward complexity as we mature and evolve, as well as when we refresh from sleep, or when we recover from sickness behavior. A characteristic of truly biologically complex signals is that as you zoom you continue to see complexity – not details. This is like the self-similarity of fractals when you zoom in or out. This complexity

represents the accumulation of skillful means such as executive control over limbic activity. Optimally Sizzle is characteristic of the EEG over the entire cortex when the eyes are open (EO). Here is the icon for Sizzle:

Tsunami appears as a series of more or less regular looking waves, just like in the icon below. In the eyes closed state (EC) tsunami occurs as the posterior dominant rhythm (PDR). Sizzle remains the dominant anterior rhythm in both EO and EC states. The posterior dominant tsunami occurs when visual processing stops due to eye closure. This lasts up to a few minutes as the visual cortex adapts to other types of processing or until drowsiness and sleep appear. Tsunami can also be seen in the fronto-temporal regions when external auditory processing goes off-line. It can also occur bilaterally in the motor cortex at C3 and C4. This is usually described as the mu rhythm. It may represent a diminished processing of external social and behavioral signals. It is characteristic of both Tsunami and Sickness behavior that when you zoom in you see detail rather than the scale-independent sizzle of complexity.

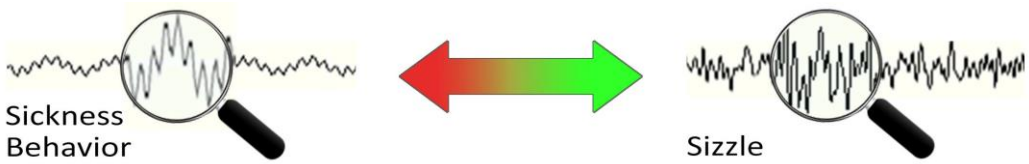


Sickness Behavior appears as fast waves riding on top of slow waves (see image below). I have called such changes away from complexity (sizzle) in the EEG a "**transdiagnostic biomarker** of sickness behavior". This pattern is observed in 1) electroencephalography (EEG), 2) heart rate variability, 3) nitric oxide regulation and 4) "dirty electricity". Sickness behavior in the EEG may occur focally or may be widespread. Unlike the sizzle of complexity, when you zoom in on Sickness Behavior you simply see a larger version of the same pattern of fast waves riding on slow waves. In general the slow waves occur in a band of EEG frequencies I call the Lower Alpha Skirt (*LAS) below 10 Hz*, and the fast waves occur in the upper alpha skirt *(UAS) above 10 Hz*, and often in the beta frequencies in the form of spindling. The relationship between the two frequency regions is called Cross-Frequency Coupling (CFC). A variety of common CFC patterns are described at tagsync.com.

By Sickness Behavior (SBeh) I also mean the canonical form, specifically the behavioral and physiological changes that accompany a toxic microbiome or chronic encephalopathy.

The Transdiagnostic Biomarker of Sickness Behavior (TDBM-SB)

Absolute wellness and absolute sickness do not exit. But wellness behavior and sickness behavior do. This means that regardless of certainty regarding diagnoses and comorbidities it is usually possible to easily identify when a trainee moves along the continuum of Sizzle and Sickness Behavior as shown below.



Any intervention that replaces sickness behavior with sizzle (complexity) is called adaptogenic. This physiological change is also observed when individuals shed repetitive, redundant and habitual behaviors. The appearance of redundant patterns in the EEG such as polymorphic slow waves, beta spindles, conserved morphologies, frontal alpha, etc., indicate a loss of complexity and skillful means.

Introduction to the Instruments

Here we will look at the different instruments which make up the dual-channel Live Complexity Training (LCT) screens and show how they work together.

Please take a moment to look at **Figure 1** below and note the instrument names. This is one of 14 LCTx2 training screens. This one gives feedback by increasing the size and volume of the DVD when the trainee is above threshold for synchrony (lower left instruments) and below threshold for redundancy (instruments 6 & 7 also known as inhibit bins). Other screens in the suite give only audio feedback, or show the DVD or other video file on a second monitor, etc. All 14 screens have the same instruments in fundamentally the same arrangement. They only differ in the type of feedback given.

Please refer to **Figure 2**. This is the Quiet Reward screen for dual channel Live Complexity Training. Note that to the right of the Spectral Display there is a second Spectral Display that is not present in Figure 1. All the spectral displays take Channels A and B, add them together, then show the power at different frequencies over time as the display cascades. The purpose for a second spectral display is to be able to show the details in a narrower band such as 35-45 Hz. Since the sensitivity of each display is adjustable you can effectively zoom in on details that you could not see in the broad band spectral display on the left in Figure 2. Only one spectral display is available in figure 1 because of the space taken by the DVD instrument.

Figure 1 – Dual Channel Live Complexity Training with DVD Feedback

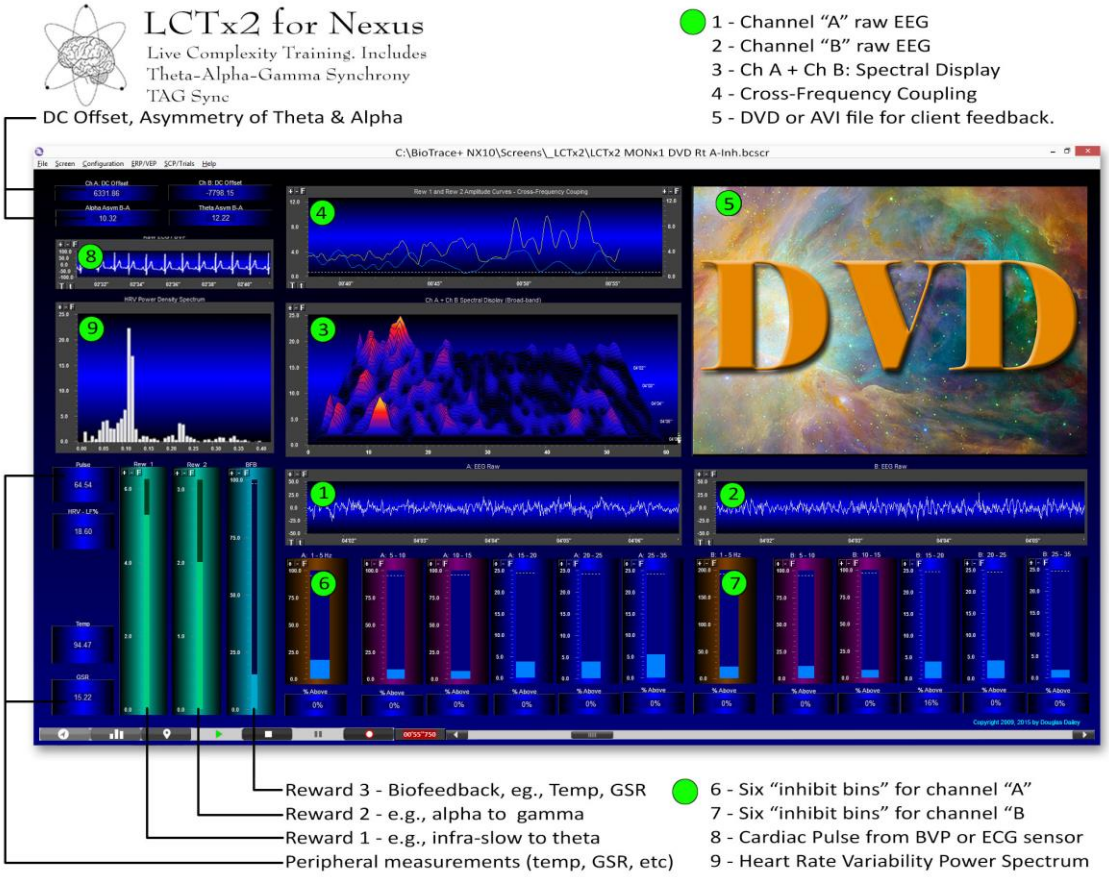
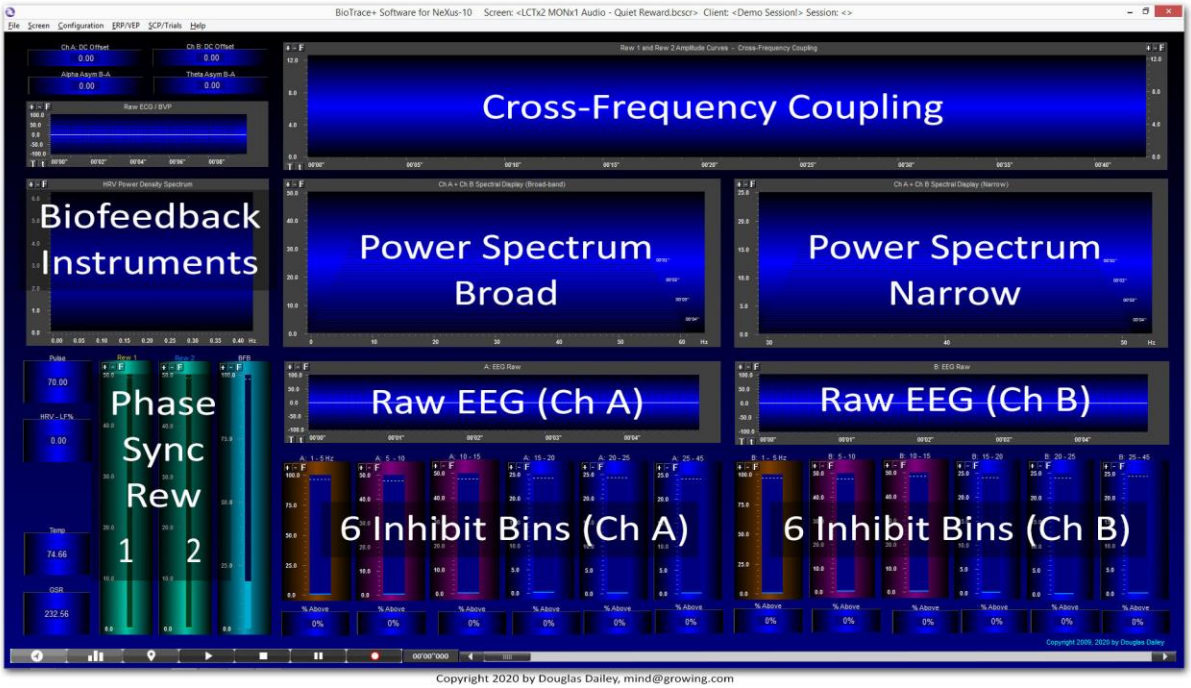
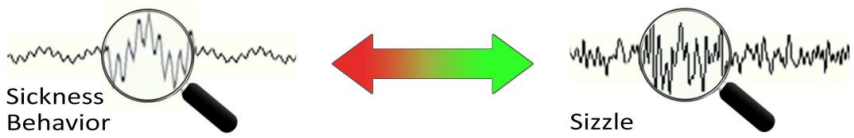


Figure 2 – Dual Channel Live Complexity Training with Quiet Reward

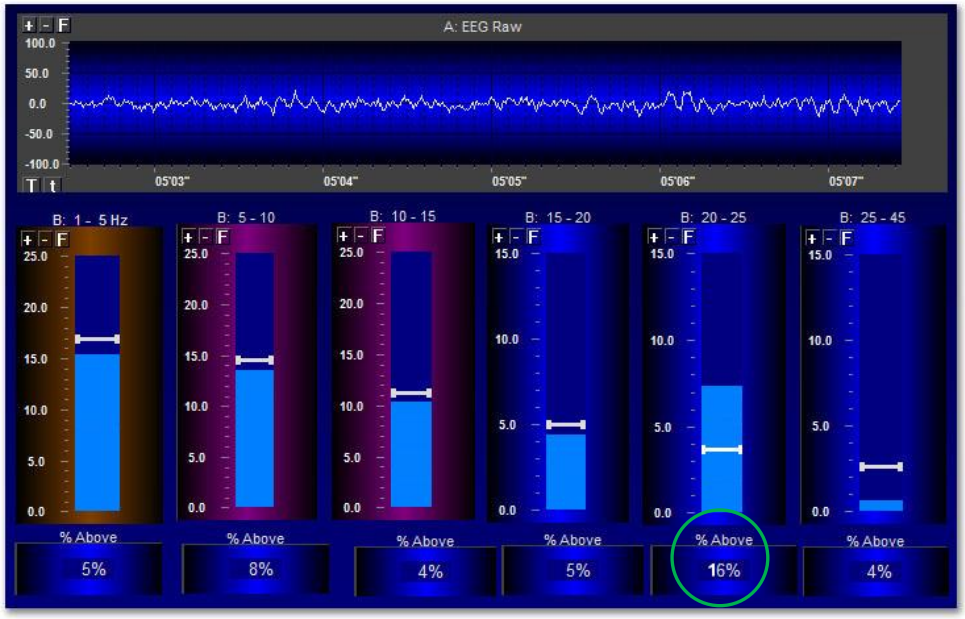


Raw EEG / Oscilloscopes: In the middle of the image above you can see the raw EEG for channel A (on the left) and channel B (on the right). These instruments are called oscilloscopes and are labeled 1 & 2 in figure 1. It is very useful to study and familiarize yourself with atlases of EEG patterns. But for our purposes we are looking for movement along the continuum from sickness behavior to sizzle.



Changes that are difficult to see in the raw EEG are often more easily detected by the "multiple inhibit bins" underneath each oscilloscope.

Multiple Inhibit Bins: **Figure 3** below shows the raw channel A input signal and underneath it are 6 vertical bar graphs with threshold indicators. These are called inhibit bins and are used to train down excess power and rogue excursions of any frequency, commonly in the lower (5-10 Hz) and upper (10-15 Hz) alpha skirts and in the beta range. When such excursions develop during a neurofeedback session they should be addressed immediately because they may represent maladaptive cross-frequency coupling of fast and slow waves. Left unattended they can lead to increased sickness behavior. This is why "bad reactions" to neurofeedback can result.



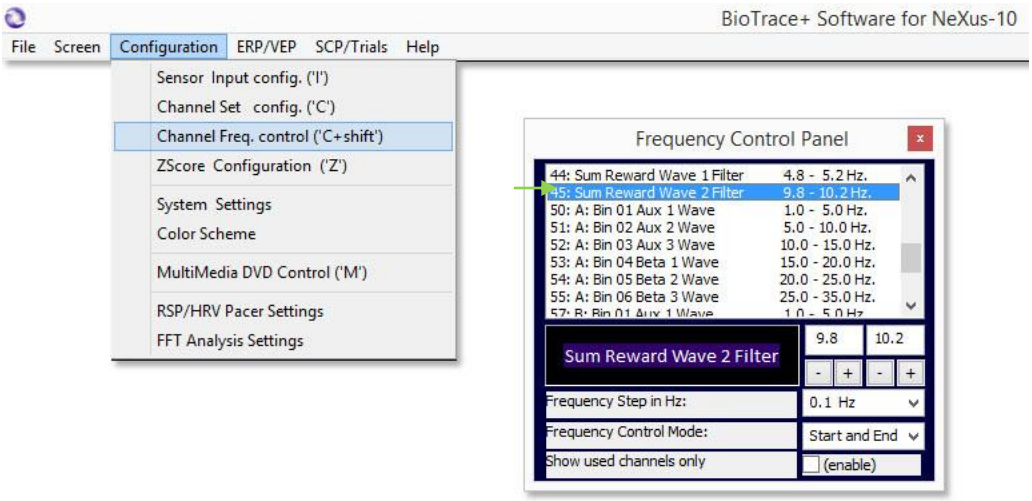
Notice in Figure 3 above as we move from left to right that the threshold bars in each bin get lower in amplitude as the frequency gets higher. This is the usual expectation and is called the "1/f power law" (pronounced "1 over f"). Repeated violation of this expectation in one or more inhibit bins may indicate sickness behavior such as inefficient, maladaptive or redundant network processing.

Note in the 5th bin above that the amplitude for 20-25 Hz activity is higher than its neighbors – a violation of the 1/f power law. We see that it has been above that threshold for 16% of the time, also higher than its neighbors. Excess energy production in a narrow beta band is often associated with poor performance. The inhibit bins are used to reduce excess energy output across the entire spectrum, especially when it involves persistent cross-frequency coupling of lower and upper alpha skirts, or when it involves spindling beta.

When you total all the "% above" values in figure 3 you get about 30%. This means that about 30% of the time the feedback will either pause or set off an auditory alert. 30% is too often for most people. Adjust the thresholds upwards so that they occur just often enough that the trainee can tell when his state has changed and the duration of silence has increased (quiet reward) or the video or music feedback has become more constant. Usually the ideal total for all the inhibit bins in both channels added together should be about 5-15%.

In the Quiet Reward screen the trainee will also produce audio alerts when synchrony between the two electrodes falls at either of the reward frequencies.

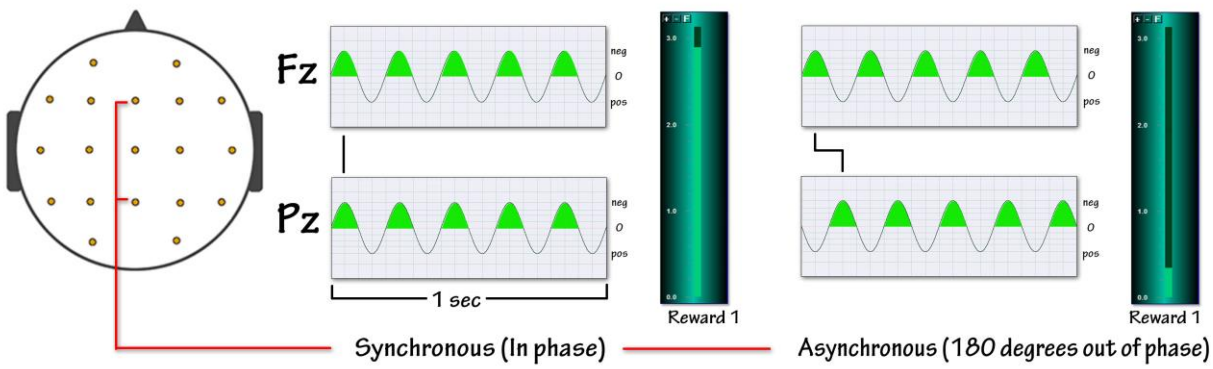
Frequency Control Panel: Figure 4 shows how to open the frequency control panel. Usually you will not need to adjust the frequency response of the inhibit bins. However you will frequently adjust one or both of the synchrony rewards – Channels 44 and 45. Your screens come with default settings for Rew 1 and Rew 2 of 4.8 – 5.2 Hz and 9.8 – 10.2 Hz. I train even more narrowly. This represents theta-alpha cross-frequency coupling (CFC). At various times you will also want to train CFC between ultra-low frequencies and high frequencies such as gamma and above.



The **reward instruments** regulate the *synchrony activity* *<u>between</u>* the two electrodes. The inhibit bins regulate the *amplitude activity* *<u>underneath</u>* each electrode. Increased synchrony between areas stimulates neuroplasticity and development of long white matter tracts. The trainee may need to support neuroprotection and neuroplasticity through dietary, environmental, and lifestyle modification.

Regions of the brain can vary widely and rapidly in their relative charges. We can measure such voltage fluctuations even at a distance from the cortex on the scalp. The voltage measurements can average as low as 5 microvolts or as high as 50 or more. Some voltages change rapidly from positive to negative. These changes happen at common frequencies described as delta, theta, alpha, beta, gamma, etc. Sometimes the concentration of electrons and negative charge is slowly altered using transcranial direct current stimulation (TDCS) or by walking barefoot in the grass. When a region of the brain has an increase in the local number of electrons then that region is said to be excitable. *For the anterior and posterior parts of the brain to communicate they must both be excitable at the same time - they must develop temporary* ***phase synchrony***.

Figure 5 shows the effects on Reward 1 when anterior and posterior theta (4.9-5.1 Hz) go in and out of phase. The instantaneous voltages in each channel are added together. When the activity is synchronous at a particular frequency (Rew 1 or Rew 2) then it combines additively and the Reward amplitude is increased. When the activity is 180 degrees out of phase they combine subtractively and cancel each other. This causes the Reward amplitude to decrease.



When the 2 parts of the brain are synchronous for part of a cycle, then they can communicate using higher frequencies during that brief phase synchronization. The higher frequencies are said to "**nest**" within the lower frequencies.

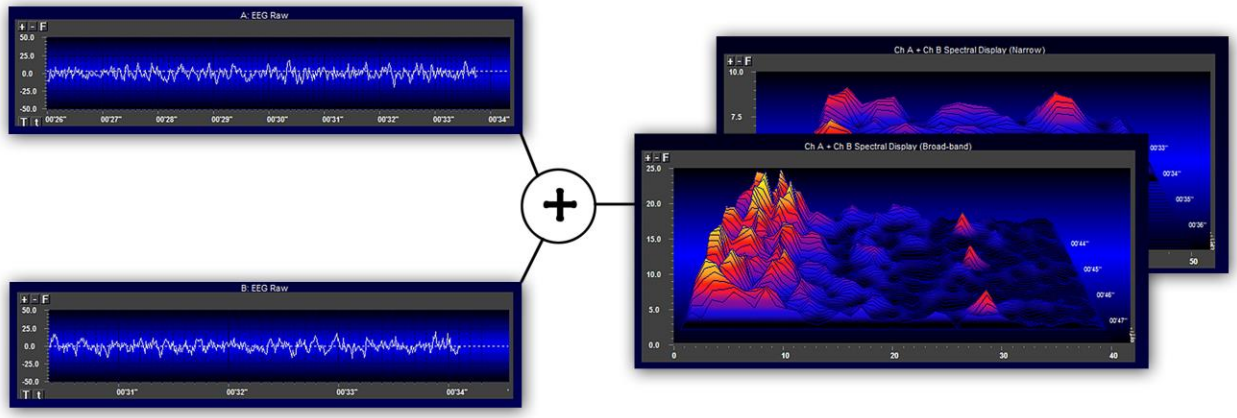
The goal of this type of training is to increase the client's production (i.e., time above threshold) of reward 1 and reward 2 in such a way that the areas underneath the two electrodes become more *synchronous with each other in two different frequency bands at the same time*. These two frequencies, Rew 1 and Rew 2, are then said to be cross-frequency coupled (CFC). Rew 1 and Rew 2 do not refer to the two channels. They refer to the two CFC synchronization frequencies, such as alpha-theta, theta-gamma, and so forth, that communicate between the two areas (channels).

The reason for the very narrow reward bands such as 9.9-10.1 Hz instead of the more commonly used 8-12 Hz is that if you want two regions of the brain to synchronize briefly (like handshaking) it will not be possible if one part of the brain is operating around 8 Hz and the other around 12 Hz. By using 9.9-10.1 Hz we provide a much more reliable indicator of when

synchrony does occur. The same applies to using 4.9-5.1 Hz for theta synchrony rather than 4-8 Hz. In the early days of theta-alpha-gamma synchronization (TAG Sync) such a narrow frequency band was called a “hailing frequency or channel”.

The goal is *not* to increase the amplitude at that narrow frequency activity under either electrode. In fact that activity at 9.9 Hz and at 10.1 Hz will be inhibited by the inhibit bins. Rather the goal is to allow brief but reliable communication between Ch A and Ch B such that higher frequencies can nest into the negative voltage troughs. This is called momentary “Global Broad-Band Synchronization – GBBS”. As I discuss at tagsync.com, the feature set required for adaptive evolutionary function is “**Global Broad-Band Synchronization (GBBS) over Small World Networks (SWNs) operating near Self-Organized Criticality (SOC) and fulfilling the Constructal Law of Physics (CLaw).** A useful mnemonic is *GiBBs SWaN plus SOCk & CLaw*. The reference to the physicist Gibbs and the Swan of Hindu mythology is intentional. [Note: This is not the swan of Greek mythology.]

Figure 6 (below) shows how the raw EEG for the 2 channels is added together and then appears in the **cascading spectral display** (**CSD**) – instrument 3 in figure 1. The CSD (also called a chronospectrograph) scrolls from top to bottom during the recording.

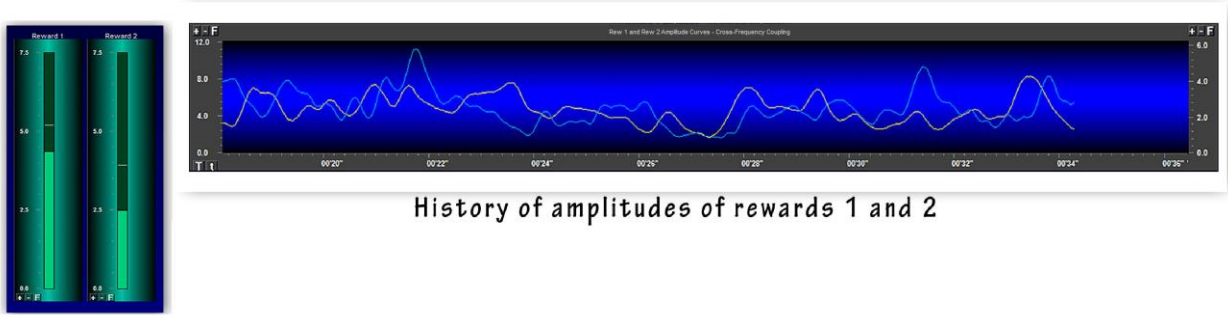


Because the spectral display adds together channels A and B, you will not be able to tell from the spectral display whether the recurrent beta spindling is coming from channel A (for example Fz) or channel B (for example Pz). However, the spindling might show in one of the raw waveforms, either channel A or B.

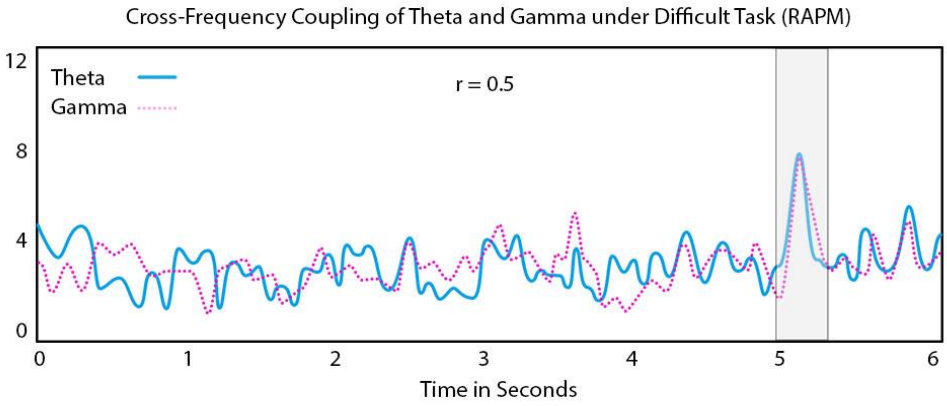
The spectral display shows the approximate voltage that was produced at every frequency from 1-40 Hz for the last 5 seconds. Normally we do not need to see spectral activity all the way to 60 Hz unless, for example, we want to see if we are picking up 50 or 60 Hz artifacts from the municipal power mains. I usually only observe up to 40 Hz since this is where most of the clinically relevant changes take place during a session.

Figure 7 below shows the **Amplitude Envelops/Curves – Cross-Frequency Coupling Instrument** that I introduced in 2009. It is instrument #4 in Figure 1. Changes in alpha theta synchrony over

time, as well as large phase resets, can be seen using this instrument. Unlike "theta-alpha crossover", a marker of drowsiness in standard alpha-theta training, theta-alpha-gamma synchrony training and LCT aim to produce self-regulation of cross-frequency coupling, i.e., the amplitude envelopes move together as seen in the top right instrument in Figure 7.



In 2014 Pahor et al (below) independently described an instrument that also allowed moment by moment comparison of theta and gamma synchrony amplitude curves and declared “These findings demonstrate for the first time that **theta–gamma cross-frequency coupling** in *frontal* areas, and partly also in *parietal* areas… relates to the **level of intelligence**.”

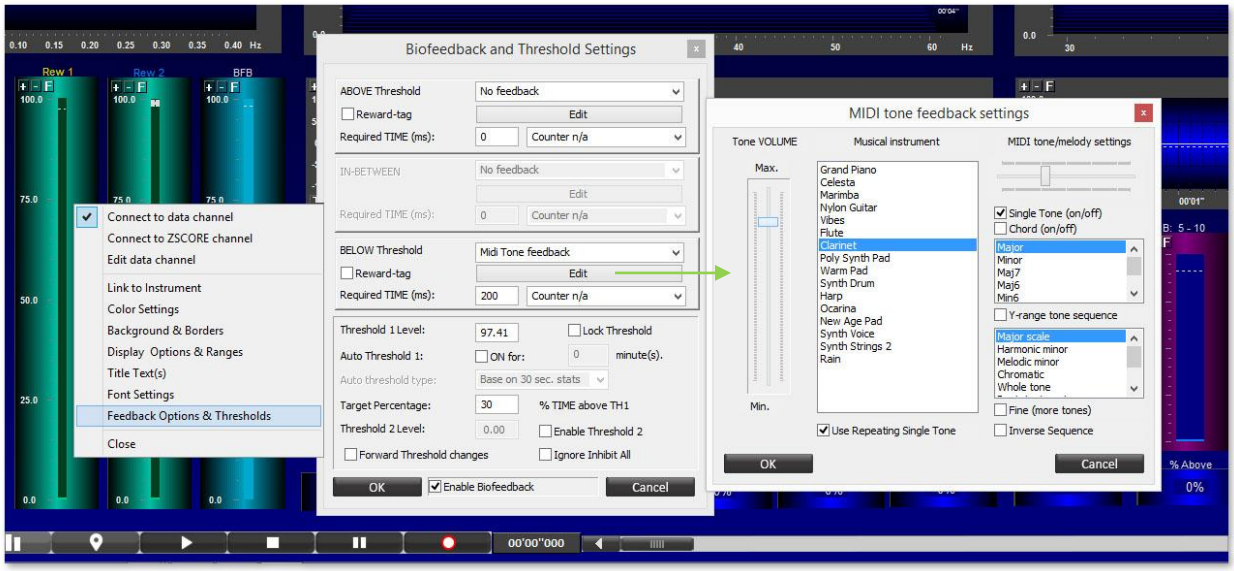


What we had already been doing with TAG Sync involved what I called the “*fronto-parietal* kernel”. It involved midline areas as well. Users learned to create the physiological amplitude curves that have been shown to relate to the “level of intelligence”. Intelligence is a valuable adaptogen. Live Complexity Training extended the model with the understanding that synchrony is used to harness complexity. Complexity (“sizzle”) was seen in relationship to sickness behavior in the EEG as described above.

Using Sounds

I prefer to use 2 dedicated external speakers plus a subwoofer on the floor for a more engaging experience. Sometimes we are limited to the speakers built into a laptop and they may not deliver low frequency sounds such as reward 1 very well. You can adjust the type, volume, and

pitch of the feedback sounds by right clicking on the reward instrument and following the windows below.



Similarly you can adjust the volume and other characteristics of the sounds produced by Reward 2 and the inhibit bins.

Be cautious not to overwhelm the trainees with sounds that are not yet meaningful to them. With some clients it is useful to give very soft feedback. Others may find that if they drift into rumination or sickness behavior it helps to have a louder sound from the inhibit bins. When using any audio feedback it should not occur such a large percentage of time that the client does not notice any difference in sound from slight changes of state.

You may have to spend some extra time to get the volumes just right for each client. You can then save the screen with a file name that includes the client's initials, such as "_JD Quiet Reward".

The Biofeedback Instruments

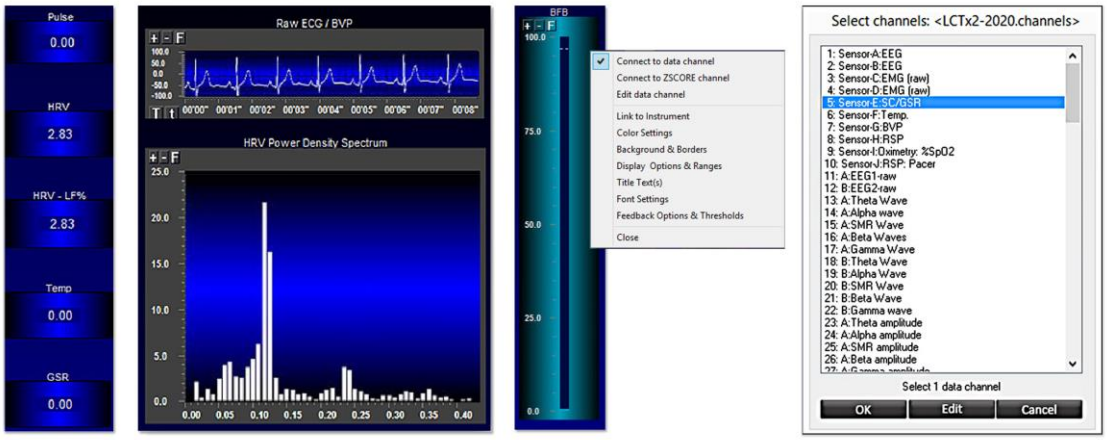
Shantideva said "The human body is the wish-fulfilling gem! In the future such a vehicle will not be easily obtainable. Use it now to cross the ocean of suffering. Wake up!" I took this as advice to use technology to assist in waking up. Awareness of changes of state in the 4 fields of body, feelings, mind and dharmas was given as the most productive and reliable guide to adaptive growth – to maturation of skillful means rather than simply getting old (not growing). In the Satipatthana sutra Buddha give an example of mindfulness of body, "Be mindful to breathe in and out slowly and regularly and to relax all the bodily formations."

If you do not already know about the concept of “heart rate variability – HRV” then please visit the National Library of Medicine at pubmed.gov and search for it. Sickness Behavior in the HRV has exactly the same pattern of fast waves riding on slow waves that I describe for the EEG. It is no coincidence. It is a result of deterioration of global broad-band synchronization of small-world networks operation near self-organized criticality and obeying the Constructal Law of Physics.

I have explained how the EEG, like HRV, can be used as a trans-diagnostic biomarker of every form of sickness behavior. This booklet is being written during the 2020 Covid pandemic. It is becoming more and more difficult to make a thorough evaluation of each client. When making life-style interventions, including TASR, it is important to have a trans-diagnostic biomarker to indicate reduction of sickness behavior in the EEG.

Since HRV, like EEG, is a trans-diagnostic biomarker of sickness behavior it may be wise to ensure regulation of HRV before and during any other TASR. It is neither uncommon nor unexpected to see some clients appear to increase regulation of EEG while suffering deregulation of HRV. This applies to self-regulation of temperature, galvanic electrodermal skin response, and habitual patterns of tension, breathing and movement.

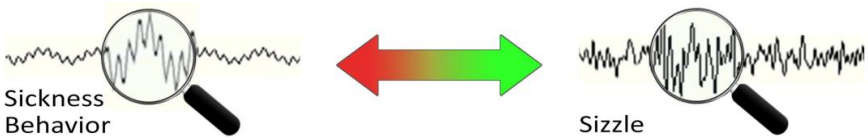
Live Complexity Training (LCT) and TAG Sync on the Nexus and on the Thought Technology platform include instruments for basic biofeedback training. The figure below shows the on-screen instruments available. It also shows how to take the “BFB” (biofeedback) instrument and connect it to a physiological data channel.



Record Keeping

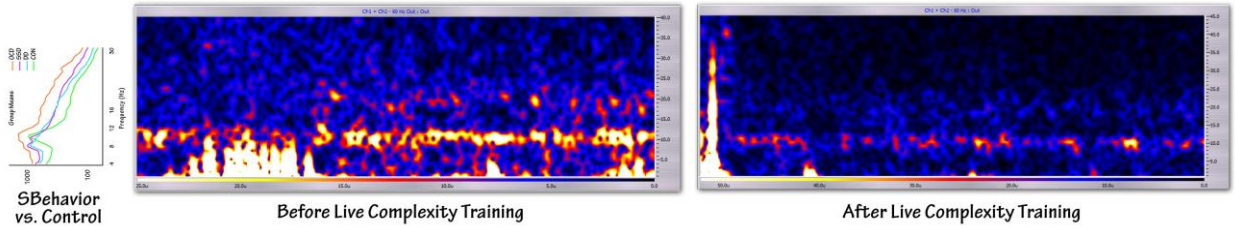
Live Complexity Training (LCT) promotes identification of changes of state. There are unreliable states (dukkha) that hinder deployment of adaptive skills. I have proposed the use of electroencephalogram and other measures as trans-diagnostic biomarkers of the change of state toward unreliable sickness behavior. With LCT the trainee is given a digital finger pointing

to the movement of the EEG and HRV along the continuum I have described as complexity ("sizzle") and sickness behavior. The goal is for the trainee to recognize such shifts and recover adroitly.



As an important record I take a screen shot when the EEG or HRV shows a state change and the client can also recognize a change of state. By pasting the screen shots into the trainee's record/notes you can compare state changes over time.

Figure 9 below shows a screen recording of the cascading spectral display before and after several sessions of Live Complexity Training (LCT). Before training the display showed the expected aspects of sickness behavior: 1) unreliable 10 Hz alpha activity, 2) increased energy expenditure in the lower and upper alpha skirts and beta (fast waves ridding on slow waves) and 3) increased cross-frequency coupling between lower and upper alpha skirts.



This is the behavior I predicted with a Kuramoto oscillator model (tagsync.com). After LCT training the total energy expenditure by the fast and slow waves has been clearly reduced from greater than 25 microvolts to less than 5 microvolts. Also notice that the 10 Hz privileged alpha regulatory signal has been considerably restored. Also note after LCT there is not the obvious persistent cross-frequency coupling between sub-alpha and supra-alpha activity.

When you take a screen shot during a change of state of the client and/or the EEG you have a way to duplicate the reward and inhibit settings as well as chart the availability of complexity. Such complex electrical activity over the small world networks of the body and brain enables us regulate, among other things, limbic over-reactivity.

It is my observation that lifestyle engineering and functional medicine are perhaps the most efficient ways to restore and promote adaptive maturation. In any case there is the high probability of sickness behavior under the control of the poorly regulated mind. With LCT there is the possibility to observe and regulate habitual maladaptive states. You may use provocation as you see fit in order to train resilience and recovery of the flow state that characterizes Constructal complexity.

A Comment on the Abhidharma

The root word –buddh means awakened. The historical Buddha stated that of all the factors leading to awakening none except perhaps mindfulness itself was as important as recognizing state changes between states of less reliability (dukkha) and states that generate and employ skillful means.

How do we know what helps us and what hinders us? In order to generalize this to most people we require a trans-diagnostic biomarker that can tell us whether we are increasing or decreasing sickness behavior with its habitual and unreliable responses.

I find it useful to equate the regression into sickness behavior and apoptosis of the self with the Buddhist concept of "dukkha". It is regrettably translated as "suffering" when the Pali word originally mean a "bad hub in a wheel". It could be that the hub is loose or eccentric with respect to the spokes that transmit pressure. The net result is that the hub is unreliable and dangerous. In LCT when the hubs of the small world networks are loose or eccentric the result is loss of reliability, loss of network capacity to carry complexity, and so forth.

Please let me know about any ambiguities or problems with this document.

Best wishes,

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