

## Letter of Invitation to Psychotherapists:

### On Neurofeedback

Biofeedback involves us in the broad interface between directed, volitional activity and the unconscious functioning of our nervous system. It is a psychological technique, being based on the theories of classical and operant conditioning. But the technique has not thus far thrived among therapists, perhaps because many of the principal applications of biofeedback fall to the domain of medical practice: insomnia, chronic pain, incontinence, neuromuscular re-education, Raynaud's disease, migraine, tension headaches, and asthma.

With Neurofeedback, however, the principles of biofeedback are being applied to brain function, and even the psychodynamic psychotherapist can no longer stand aside. As it happens, the first application of Neurofeedback was also to a medical condition, namely the control of seizures. And the discovery was entirely accidental. It was also somewhat unwelcome, having been made during the dark ages of neuroscience when the idea of brain plasticity was not yet accepted. Cats were operantly conditioned to maintain motoric stillness in order to obtain food reward. Under such conditions, an idling rhythm appeared in the cat's EEG.

Once the contingency of this EEG spindle-burst on motoric stillness was firmly established, the experimental paradigm was turned around to reward the cat for the appearance of this particular rhythm rather than for the behavior, and that also succeeded: motoric stillness ensued, and EEG feedback was launched. This experiment ties together the realm of behavior and of voluntary motor control with the realm of brain states and of EEG phenomenology. Later, in an unrelated experiment, it was found that these trained cats were more resistant to chemically induced seizures.

We may consider all of the mental activity that is of interest to the therapist as being organized by brain networks that are in continuous communication with one another and in a state of ongoing mutual regulation. The entire realm of behavior is "mechanized" (pardon the term) at the level of our neuronal networks through complex mutual interactions that unfold in the bioelectrical domain. Seeing the EEG allows us a window into the complexity of this communication. Fortunately, it turns out that the brain utilizes some simple organizing principles to conduct its affairs.

Fundamentally, the brain orchestrates its activity by organizing neurons to fire in groups that act in unison. This means that the brain must be organized for massive parallel processing, and in order for the whole network to interact properly, brain timing must be managed over the whole cerebrum at the level of milliseconds. This sets a high bar for the integrity of brain function. It goes without saying that there are many ways this can go wrong, with implications for brain function that can go from minor things like the failure of memory access to commonplace failures such as migraines or panic and to major issues such as seizures, cataplexy, or ultimately coma or vegetative states.

What we get to see in the EEG is neuronal activity organized into many different frequencies, each operating independently and segregated from others, much like different radio stations. At each of these frequencies, we see the neuronal groupings form then dissipate again, arising as needed to support one function or another. Seen collectively, it is a cauldron of activity that looks much like noise. But what looks like noise is actually meaningful brain activity. If we now introduce operant conditioning into this process, rewarding the trainee for the momentary alteration of one of these brain rhythms, we alter network function and evoke the brain's response. At one level the brain will respond to the rewards with which we beguile it into compliance, but at another level it will also resist the change in state

because we will have interfered with its intentions. We will have subtly "stressed" the brain, and if this process is continued the long-term outcome will be enhanced regulatory robustness.

If we apply this technique to the motor cortex, as was done with the cats, we can expect to see improvements in motor control along with an enhanced capacity for accessing calmer states. And if we apply it to the pre-frontal region of the brain, our intervention will serve to activate our executive functions and enhance inhibitory control over a variety of adverse behaviors. If the training is continued over sessions, we give the brain an opportunity to consolidate the learning of this enhanced regulatory control.

The most typical application of this technique in a therapy practice will be to the control of anxiety. Traditional biofeedback techniques such as simple handwarming were already adequate to this task, but we can now steer the process better with EEG feedback. The problem is that anxiety, while troublesome, also represents a kind of felt safety zone for people who have lived in that state for most of their lives. They may be acutely uncomfortable, but they may also be unable to let go. With EEG feedback they can be moved gradually and incrementally toward calmer and more controlled states, all the while remaining within their comfort zones.

Related to this work is recovery from depression. There are many aspects of depression that are not amenable to verbal appeal. There is the inability to enjoy positive emotions and the difficulty mobilizing for engagement. There is also agitated depression and suicidality. These aspects of the whole depression spectrum can be accessed with feedback techniques. This is most dramatically obvious in the treatment of suicidal depression, where the use of feedback can often abort a suicidal episode within a single session.

In the discovery of the physiological basis of psychological states we were preceded by psychopharmacology. But by now we know how limited the possibilities are for restoring good function if one is required to rely largely on medications. The anti-depressants are barely better than placebo (and not even that in the case of children). Moreover no good model has emerged for their effects. Depression is not a matter of serotonin deficiency, for example. Drugs that target norepinephrine can be just as effective. So the upshot is that the medications alter system functioning more broadly.

The same is true of Neurofeedback. However we train the brain, we influence the entire cerebral network because its organization is tightly integrated. But in comparison with medical management, we can bring much more subtlety to bear. The work proceeds much like traditional therapy except that the behavior that is being shaped is brain behavior, one level below overt organismic behavior. This behavior does not need to be discussed; it simply needs to be understood sufficiently to be targeted in training. In this approach, the brain is treated as the behaving entity, and the EEG is the observable manifestation of the behavior. In feedback, the brain becomes the observer of its own EEG. We 'bias' that information toward a desired outcome, and the brain is gradually shaped toward better behavior. We judge the results, of course, as usual in terms of overt behavior.

If we now look at the work with the anxiety-depression spectrum collectively, much of what is currently clinically intractable is grounded in disorders of attachment that are traceable to missed early developmental stages. The most difficult conditions encountered in clinical practice, from reactive attachment disorder in childhood to borderline personality, sociopathy, and dissociative identity disorder (DID) in adulthood, are all traceable to the incapacity to establish firm and positive attachment bonds. This follows from the fact that these nervous systems live in raw, unmodulated fear. Their world was never experienced as safe. In particular, it is not safe for attachment. Now that we finally understand this, what is the remedy?

If we regard this issue from the standpoint of neural networks, the remedy presents itself: train the networks by which fear is modulated and emotional bonds are formed. This is doable, and it is being done. The effectiveness of this approach makes the case that when the dysregulations are profound and

thorough-going, the psychophysiological approach should precede the psychodynamic. The groundwork must be laid in the neural architecture for the more refined process of psychotherapy to even have a beachhead.

Another central feature of borderline personality and DID is the manifest instability of state. With Neurofeedback, stability in brain function can be targeted independently of anything else. This has implications for a multitude of conditions where the brain is unstable, ranging from vertigo and bruxism episodes to migraines, panic disorder, bipolar disorder, schizophrenia and seizures. Whenever such instabilities are present, they need to be the first concern for the Neurofeedback practitioner.

Therapists who have brought Neurofeedback into their practice have sometimes confided that they actually feel a bit guilty charging their usual fees because they are not working nearly as hard as they used to. The process of Neurofeedback must be competently guided, but beyond that the therapist is largely a witness to the unfolding chain of events. The brain must be brought to the point where it owns the competence of self-regulation across all of the domains of function—the regulation of arousal; the deployment of attentional resources; the status of executive function; the domain of affect regulation; the refinement of motor function; the sensitivity and reactivity of our sensory systems; specific cognitive function and working memory. All of these functions are now within our clinical reach through feedback.

The focus in the above has been on the self that engages the world. It is failures in that domain that fill the therapist's appointment ledger. Beyond that, however, lies the realm of the existential self, of the experienced self. Neurofeedback is relevant here as well. We already know from the meditation disciplines of the value of the encounter with the core self, but we also know the process to be very inefficient (at least in our Western time-driven perspective). With Neurofeedback, the internal conversation can be directly facilitated by reinforcing particular network states.

The mechanism is at one level unambiguous: with Neurofeedback, we are capable of moving most people to states where they feel safe—safe enough at any rate for the process to get underway. What happens then must remain ever a private experience to which any verbal input would be disruptive. The best we can do is to arrange for the circumstances to be propitious, and now this includes the direct promotion of certain brain states. What makes particular states productive in this regard? They enlarge the scope of awareness of the self by bringing larger brain regions into the internal conversation—a process that is experiential rather than verbal. These larger brain regions become part of the neuronal dance just long enough for the experience of sudden insight, of resolution, of surrender, of a sense of fulfilment, of spiritual emergence...in short, of whatever is needing to happen at that moment with that self. The existential self is in charge here, once it is allowed to have the stage. The therapist's role is once again that of a competent, supportive witness to the unfolding process.

Where is this process rendered most problematic? It is in the event of a trauma history. The traumatic event has in common with developmentally based attachment disorder that it gives rise to raw, unmodulatable fear. Again the first order of business is to calm the fear response that is now on automatic pilot (i.e., the relationship to the outside world). The next order of business is to give breathing room to the traumatized self (i.e., attending to the inner realm). Neurofeedback is relevant to both in the most humane way possible, namely by giving maximum scope to the internal resources of the self that already exist, but are simply functionally constrained.

In the above, the case has been made implicitly that once we have access to the realm of brain behavior as manifested in the EEG, a new therapeutic opportunity opens up that potentially covers the entire realm of mental health. The more intractable the condition at issue, the more likely it is to be grounded in physiology. Much of this can still lie in the functional realm that is accessible to us through reinforcement techniques.

Three core issues have been identified as organizing principles for the most intractable conditions where Neurofeedback should complement psychotherapy: 1) basic stability and continuity of brain

function; 2) developmental deficits in the learning of attachment; 3) the trauma response. Each of these is centrally at issue in one of the new challenges we are confronting in the clinical world: Instability is the key issue among the children increasingly being identified as bipolar; attachment disorder is a key issue in the autism spectrum; and the trauma response is the key mental health issue among our returning veterans. Neurofeedback has been discovered just in time to address the escalating crises in mental health in our society. We invite the psychotherapist to add Neurofeedback to the practice and to participate in populating this frontier of mental health.

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**Additional Resources:**

The Open-Focus Brain: Harnessing the Power of Attention to Heal Mind and Body, by Les Fehmi and Jim Robbins

Handbook of Neurofeedback: Dynamics and Clinical Applications, edited by James Evans

The Protocol Guide for Neurofeedback Clinicians, Susan Othmer

Introduction to Quantitative EEG and Neurofeedback, edited by James Evans and Andrew Abarbanel

Awakening the Mind, Anna Wise

Change Your Brain, Change Your Life, Daniel Amen

Reclaiming Cognition: The Primacy of Action, Intention and Emotion, by Rafael Nunez and Walter Freeman