

## **Reflection on the Respective Roles of Somatic Biofeedback and EEG Neurofeedback**

### **By Siegfried Othmer**

This past November, I had a chance to attend two of the regional Biofeedback Society conferences, the Western Association of Biofeedback and Neuroscience's 41<sup>st</sup> annual conference and the Northeast Region Biofeedback Society's Annual Conference. Both reflected the emergence of new vitality within the field, with growing interest in Infra-Low Frequency neurofeedback, as well as low-level magnetic stimulation and Heart Rate Variability. On the East Coast, there was an additional emphasis on infrared thermal training of brain function, as well as virtual reality for help with fear of flying.

At the Western Association of Biofeedback and Neuroscience conference, Sue Othmer recapitulated thirty years of work with EEG biofeedback by discussing each of the milestones of progress along the way. It is difficult to place myself in the frame of mind that existed in 1985 with respect to the prospects of training brain function. 30 years ago, neurofeedback was in its own little universe, seeking a beachhead, with the introduction of SMR and beta training after alpha training had ostensibly been discredited. Every subsequent advance in neurofeedback methods and techniques was fiercely resisted by those who had themselves pioneered earlier developments in neurofeedback. Sue Othmer was never deterred by the critics. Rather, we were handicapped by the blinders on our own perspective, which at times stunted the

developmental trajectory. Today, in retrospect, matters look very different.

An underlying theme at both conferences, whether implicitly or explicitly, was the relationship between traditional biofeedback and neurofeedback, which is still being sorted out. During Sue Othmer's presentation, this issue was put on the table by Erik Peper. He discharged his question more as a challenge: "Why do you restrict your attention to a single measure, the EEG?" he asked—perhaps not in those exact words. Obviously the case for Sue Othmer's exclusionary use of neurofeedback has not yet been validated to his satisfaction. Most likely, he spoke for a number of other attendees.

As it happens, I addressed that very topic in my talk the next day. The singular advantage of neurofeedback (over biofeedback) is that it engages the frequency basis of cerebral organization. In first instance, this makes every minute and specific brain activity easy to detect. Secondly, it allows the brain to discriminate even subtle frequency-based feedback. Thirdly, the brain is strongly responsive to information on its own frequency-based activity. And finally, the brain is highly responsive to even low-level frequency-based stimulation. So we take advantage of these sensitivities—either with neurofeedback or with stimulation.

How much difference it makes to have information encoded in frequency can be easily illustrated with our sense of hearing. The playing of a piccolo in Times Square can be readily discerned even if the sound level it creates at the listener's ear is much lower than the ambient noise. Similarly, one can look at the record groove of an old LP under a magnifier and see only the dominant signals. But if that same record is played, one has no difficulty distinguishing the whole variety of

instruments in the orchestra. A similar advantage is conferred upon neurofeedback. The brain that offers us such refined discrimination in hearing can also deploy such skills more generally.

The frequency basis of neural organization gives us a much larger clinical workspace with neurofeedback than we have in somatic biofeedback. With the entire frequency domain, as well as the spatial domain at our disposal, we can work across the entire continuum from core regulatory function at one end (arousal, affect, and autonomic regulation), to much more specific cortical function at the other (e.g., articulation, working memory). This means we get to work with functions that have no headroom limit (intelligence, memory, fine motor control), which takes us well beyond the interests of standard biofeedback.

Additionally, we have the opportunity to work with conditions for which few other remedies exist: traumatic brain injury is perhaps the best example; suicidality is another; dementia is a third. Further, neurofeedback has no peer in resolving migraine conditions. For the vast majority of migraine sufferers, neurofeedback could well be the categorical remedy. After some brain training sessions, no more migraines. The only somatic biofeedback methods that come close to these outcomes are those that also appeal to brain function directly: Passive Infrared thermal hemoencephalography training (PIR HEG) and near infrared reinforcement hemoencephalography training on blood oxygenation levels (NIR HEG). Finally, neurofeedback can achieve functional improvements in the autism spectrum and in cases of developmental trauma that cannot be matched by other methods. And within the domain of psychology, we achieve results that are unparalleled in

application to addictions, to personality disorders, and disorders of dissociation.

The second challenge directed at Sue Othmer by Erik Peper was the assertion that Eugene Peniston's work on alcoholism only succeeded in remediating addiction when the trauma was also resolved. This was a "gotcha" on the assumption that the trauma could only have been resolved in the old-fashioned way, that is by means of the psychological methods that Peniston also relied upon in his studies. By implication, surely the EEG feedback could not be credited with the resolution of PTSD because it deals with an issue that is psychological in its essence.

Indeed, it is true that the resolution of the alcoholism went hand in hand with the resolution of PTSD. And indeed Peniston's inclusion of a variety of methods, including psychotherapy, renders the question of mechanisms moot. But that issue has certainly been resolved since that time. The work with PTSD using our own methods now covers more than 1,000 service members at just one military base. The method of resolution is infra-low frequency training, plain and simple. Not even much Alpha-Theta training is involved. And there certainly wasn't much psychotherapy being done. And yet PTSD resolved quickly and consistently. Many of these service members even returned to combat duty overseas after their training.

Once good psychophysiological regulation has been restored, PTSD is no longer diagnosable or even identifiable. These young service members aren't signing up for psychotherapy, by and large. It's brain training and out for most of them. It may indeed have been psychological trauma that triggered the PTSD in the first place, but the regulation of physiology suffices

to eliminate it. In a stable, well-regulated physiology, traumatic memories no longer trigger re-experiencing. There is no need for any exposure therapy. There is no need to revisit the content of a traumatic memory. And alcohol is no longer needed to soothe a wounded psyche in distress. (Incidentally, the same holds true for the Vietnam era veterans who have lived now for some forty years with PTSD. Their recovery relies mainly on infra-low frequency training.)

The third question Peper threw at Sue was why we weren't just using the slow cortical potential (SCP) training developed by Birbaumer decades ago in Germany. That's a strange question, a bit like asking 'why do you choose to lead when you could just follow?' Such questions are not answerable. Barry Sterman felt compelled to follow up on his accidental discovery, and Sue Othmer had a similar impulse to follow up on her findings. The SCP technique, like Sterman's SMR training, is a single approach with a standard placement, and its benefits have been well scoped out. The trainee is repetitively reinforced on transient change in the slow cortical potential. Eventually cortical excitability comes under better management. The method is comparable to SMR-beta training in its effectiveness and has comparable clinical scope.

Once again the answer to Erik's question takes us back to the frequency-based organization of neuro-regulation. It turns out that this organizational schema holds even deep into the infra-low-frequency region. Sue simply extended her frequency optimization procedure to an ever broader range of frequencies, as clinical experience mandated. Through the simple expedient of zeroing in on one or another of these special frequencies, we provide the brain with salient information on its own state. Because regulation is organized as resonant systems, operating at these frequencies maximizes

the sensitivity of the overall feedback loop. The brain utilizes this information to re-normalize large-scale functional connectivity of the core networks.

By working with frequency-based information at low frequencies one can offer continuous feedback on the unfolding signal, so the brain is being engaged continuously rather than on a transient basis. This makes for much greater efficiency in the training.

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It is apparent from the above that with neurofeedback we are finding ourselves in a very different environment from that of the practitioner of somatic biofeedback. The two fields are largely complementary, albeit with a substantial overlap. They each have their domains of uniqueness where the other is not applicable.

We can all have our opinions about how we cohabit in the future, but we also know that key decisions will ultimately be rendered in the marketplace. I don't see many biofeedback clinicians making their living primarily from offering traditional biofeedback services in independent practice. These methods are typically ancillary to a more primary occupation. By contrast, neurofeedback therapists are quite likely building their practice around brain training. They are already succeeding even before insurance companies are playing much of a role. This means that the public is voting with its own pocketbook.

Meanwhile, we are all persuaded that there is really no alternative in healthcare to the universal adoption of self-

regulation as an obligation for mankind in the modern world. Healthy living cannot be outsourced. Likewise, there is no alternative to the broad adoption of the self-care model even within the medical realm. This is the base of common interest for biofeedback and neurofeedback.

Here somatic biofeedback is the low-hanging fruit. It offers face validity, ease of access, personal involvement, and affordability! Every kind of training offers specific as well as general benefits. When our society finally lays claim to the self-regulation technologies, autonomic regulation with the aid of somatic biofeedback will have first priority. It will eventually become universal, incorporated into the school curriculum, and thus become common knowledge.

Neurofeedback, on the other hand, will increasingly take on the heavy lifting. It will bring about a revolution in psychology, psychiatry and neurology, as well as in medical specialties such as pediatrics, gynecology, neuro-rehabilitation, and geriatrics. There is no real conflict here. We need to recognize our common interest in the promotion of the self-regulation remedy and the options for self-care. This requires that we move beyond our historical tribalism.