The Imperative Utilization of Self-Regulation Technologies in Health Care

Siegfried Othmer, Ph.D.
Chief Scientist, The EEG Institute
Western Association for Biofeedback and Neuroscience
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Materials that are included in this course may include interventions and modalities that are beyond the authorized practice of mental health professionals. As a licensed professional, you are responsible for reviewing the scope of practice, including activities that are defined in law as beyond the boundaries of practice in accordance with and in compliance with your professions standards.
Abstract

Failure modes exist in the realm of human disease, disorder, and dysfunction that do not lend themselves to description in terms of a classic medical model, nor do they yield to prevailing medical remedies. This is the realm of functional disorders, of learned dysfunctions, and of maladaptive brain plasticity. The failure to recognize the expansive dimensions of such learned dysfunctions has enormous consequences in terms of the needless exacerbation of human suffering, the misapplication of medical remedies, and the resulting overall cost of medical care.
The Self-Regulation Technologies constitute the imperative remedy for these conditions. That is to say, no effective alternative exists. With the recent addition of infra-low frequency neurofeedback to the inventory of potential remedies, the obligatory embrace of self-regulation technologies within healthcare is becoming increasingly compelling. Examples of medical interest ranging from traumatic brain injury to the dementias will be covered in the talk. Particular emphasis will be placed on developmental disorders and on addictions.
The domain of self-regulation

Thesis:
Domains of both medical and psychological services exist in which the only appropriate remedy is a self-regulation remedy, one in which the capacity for self-regulatory competence is enhanced, typically with the aid of instrumental support.
The current state of affairs

Somatic Biofeedback:
• Accepted as valid within Medicine, but trivialized in terms of its relevance to healthcare
• Largely seen as optional in the arsenal of medical remedies

EEG Neurofeedback:
• Not yet accepted within Medicine, and disparaged in terms of its significance even if validity were to be proved

As is often the case in questions of professional prerogatives, the claims for NF and BF are not welcomed by the caring disciplines, but rather seen as a threat.
Dysautonomia Information Network (DINET)

The search term ‘biofeedback’ yielded nothing!

Biofeedback has been successfully ‘turfed’ out of the field of view of medicine

https://www.dinet.org/search/?&q=Biofeedback%20from%20any%20date&type=ms%20records2&sortby=relevancy search conducted 9/19/17
Pelvic floor dysfunctions:

• BF is reimbursed only after surgery fails....
• This has it backwards...
Where does Somatic Biofeedback play an indispensable role?

- The work of Bernard Brucker on spinal cord injury
- Pelvic floor work
- Trigger Point Pain? (“The pain cycle”)
- Raynaud’s?
- Dystonia
- Hyperhidrosis
- Dysautonomia
- Somatization disorders
Cannon on homeostatic mechanisms

• If a [homeostatic] disease does develop, then homeostasis actively maintains it until we do something about it.
  • Cannon

• “...the internal referents cannot be absolute, but rather only relative. So Cannon recognized that even if the homeostatic system establishes itself at a non-optimal operating point, homeostatic mechanisms may actively maintain it. The system serves to achieve a local optimization, not necessarily a global one.”
  • New Mind, New Body by Barbara Brown
Local vs global optimization
Where does neurofeedback play an indispensable role (in the medical perspective)? (Partial list)

- Developmental disorders
- Autism Spectrum
- Cerebral Palsy
- Traumatic Brain Injury
- Autoimmune disease
- The dementias
- Parkinson’s
- Obesity
- Type II Diabetes

- Suicidality
- Panic disorder
- Medically Intractable Epilepsy
- Addiction
- Chronic Pain
- Chronic Lyme disease, etc.
- PMS
- Anorexia and bulimia
- Asthma
Where does NF play an indispensable role in mental disorders? (DSM Model)

- Bipolar Disorder
- Schizophrenia
- PTSD
- Tourette Syndrome /OCD/ Trichotillomania
- Personality Disorders
- Dissociative Identity Disorder
- Oppositional-Defiant Disorder/Conduct Disorder
- Attachment Disorder
Crossing the boundary of mental and physical illness:

ALPIM Syndrome

• A = Anxiety disorder (mostly panic disorder);
• L = Ligamentous laxity (joint hypermobility syndrome, scoliosis, double-jointedness, mitral valve prolapse, easy bruising);
• P = Pain (fibromyalgia, migraine and chronic daily headache, irritable bowel syndrome, prostatitis/cystitis);
• I = Immune disorders (hypothyroidism, asthma, nasal allergies, chronic fatigue syndrome); and
• M = Mood disorders (major depression, Bipolar II and Bipolar III disorder, tachyphylaxis.)
Penumbra of medical conditions, treatments

- Psychiatric aspects of infectious diseases
  - Viral encephalitis
  - Brucellosis
  - Toxoplasmosis
  - HIV
- Neuropsychiatric side effects of drugs used for treatment of infections
  - Mefloquine, interferon-alpha
- Neurological aspects of Lyme disease
- Migraine does not come in the door alone
Migraine and tension-type headache

- Anger ($p < 0.05$)
- Anxiety ($p < 0.05$)
- OCD ($p < 0.01$)
- Depression ($p < 0.001$)
- Phobias ($p < 0.001$)
- Emotional Lability ($p < 0.001$)
- Psychophysiological disorders ($p < 0.001$)

PICS, POTS, and PANDAS....

- **PICS** Post-Intensive Care Syndrome
- **POTS** Postural Orthostatic Tachycardia Syndrome
- **PANDAS** Pediatric Autoimmune Neuropsychiatric Disorders Associated with Streptococcal Infections
- **POIS** Post-Orgasmic Illness Syndrome
- **PUMP head** Cognitive decline post cardiac bypass surgery
- **PCCD** Post-Chemotherapy Cognitive Decline
- **PGACDAES** Post-General Anesthesia Cognitive Decline Among the Elderly Syndrome
Compound problems--

- Rheumatism and St. Vitus’ Dance (Mark Twain)
- Addiction + Anti-Social Personality Disorder
- Obesity + Tourette Syndrome
- Lupus + seizure disorder
- Cancer + anxiety, fear, and depression
- Diagnosis with a chronic or fatal condition constitutes a psychologically traumatic event
“It appears noteworthy that people with neoplasia do not receive the necessary psychological support. According to research data, 43% of patients with cancer do not receive any kind of mental health service.”
Logarithmic Plot:

SCL-90

Before N/F  After N/F
Logarithmic Plot:

STATE ANXIETY

NEUROFEEDBACK SESSIONS

Before N/F
After N/F
Diagnostic Tunnel Vision

A core diagnosis may command all the medical attention and resources, diverting attention from ancillary conditions

Our son Brian:

- Diagnosed with Temporal Lobe Epilepsy
- Tourette Syndrome
- Asperger’s
- Episodic Explosive Disorder
- Childhood Bipolar Disorder
- Suicidality
- Paranoia
Other conditions

• Bell’s Palsy
• Sudden sensorineural hearing loss
• Post-partum depression
• Anosognosia, etc.
Loss of somatosensory awareness, sense of self

Oliver Sacks has shed light on the catastrophic consequences of the loss of somatosensory awareness, which entails a substantial loss of the sense of self. The somatosensory system is the only one that presents us with such a hazard. This condition tends to afflict highly intellectual people preferentially, and it can subside as readily as it arrived. A functional mechanism is therefore indicated. This places it in the class of conditions that are expected to respond to a functionally based intervention such as neurofeedback.
Medical casualties: Errors of Commission

• Some 250,000 people a year die of medical errors, is the third leading cause of death in the USA (Makary & Daniel, 2016)?


• This compilation is necessarily quite conservative, since it must rest on documentary evidence.

In practice, the vast majority of medical errors are not reported as such, or even recorded as such
Medical Casualties: Errors of Omission

• What is the death and disability consequence of what the field of medicine is not doing?
• “If you don’t want to make the diagnosis, don’t order the test.”
• If a medical remedy is not available, the condition tends to drop out of the conversation. The patient is referred on.
• “The crock has been turfed.”
• Medically unexplained symptoms: refer to a psychiatrist
“Medically Unexplained Symptoms”
Functional Disorders

History of Marginalization:
• Hysteria (19th century catch-all)
• Conversion Disorder (1980)
• PMS
  • ‘Late Luteal Phase Dysphoric Disorder’ – DSM III Appendix
• MS (“Faker’s disease”)
• Stomach ulcers (“stress reaction”)
• Myalgic Encephalopathy (ME) (“Yuppie Flu”)
• Lyme disease
• “Bodily Distress Syndrome” (the latest)
Inadequacy of medical remedies utilized in isolation

Schizophrenia:

“The prognosis for the majority of schizophrenic patients is bleak, especially if they only receive contemporary medical treatments. About 90 percent will remain unwell and nonfunctional for the rest of their lives despite receiving the most advanced drugs and social services currently available.”


Parkinson’s – medical remedy is problematic

• Boosting dopamine affects both VTA and SN... with possibly detrimental effects on the VTA.... Addictions...

• Whereas NF can be selective...

• “Parkinson’s disease is associated with depletion of tyrosine hydroxylase, dopamine, serotonin, and norepinephrine. Exacerbating this is the fact that administration of L-dopa may deplete L-tyrosine, L-tryptophan, 5-hydroxytryptophan (5-HTP), serotonin, and sulfur amino acids.”

• https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3068871/
Progressive disregulation with age
Benzodiazepines

• “Odds of dementia were 78% higher in those who used benzodiazepines compared with those who did not use benzodiazepines.”

• “...statin drugs were associated with increased risk of dementia.”

Opiate addiction

• 100 dying per day in the US due to opiates
• Related healthcare costs> $25B
• Related criminal justice costs> $5B
• Total economic costs (in addition) ~$80B
• Doesn’t count economic value of loss of life

Note:
• 175 dying per day due to overdoses in general
Pregnancy

- The problem of drug use before and during pregnancy
- Prenatal Maternal SRI use affecting infant brain maturation
  - Sampsa Vanhatalo
“The Worried Well” and the Threshold Problem

• The vast majority of appointments with primary care practitioners are for conditions that do not rise to the threshold of a medical diagnosis
• Leading to the broad adoption of palliative care
• Palliative care then functions to forestall the search for a proper remedy
• This allows the Disregulation Cascade to progress unimpeded
• Ultimately, the result is a chronic condition for which few remedies exist...
Distribution of Apparent Functionality

The Domain of Early Trauma, Developmental Disorders, Adverse Childhood Events (ACEs)
The Disregulation Cascade

- Attachment issues
- Early childhood ‘events’
- Football injury in adolescence
- Wartime trauma

Secular progression into dysfunction
The Disregulation Cascade

- Full recovery with healthy start and sufficient recovery time
- Cumulative dysfunction with early trauma history
The Disregulation Cascade

Full recovery with healthy start and sufficient recovery time

Cumulative dysfunction in the absence of adequate recovery time
‘Minor’ Traumatic Brain Injury

• A substantial unrecognized factor in the Disregulation Cascade is minor head injury
• The field of Medicine still lacks understanding of mTBI
• Talk is either of concussion or CTE:
  • Concussion is expected to be self-remitting
  • CTE occurs late in life and there is no remedy
• The real problem lies in between…
  • This is where NF does well
Grim reality of our Western lifestyle

• Living in our Western reality, we are far more disregulated than we know
  • Prevalence of sleep deficits
  • Prevalence of headache in the population
  • Prevalence of minor, somatic complaints
  • Prevalence of domestic strife, violence
  • Prevalence of burnout phenomena
    • A substantial fraction of the German population declares itself to be near burnout.
    • German society is presently regarded as a model in the developed world
Burnout in pediatric residents

“High levels of emotional exhaustion and desensitization, and low levels of personal accomplishment and job satisfaction were found in residents of pediatrics.”

- Emotional exhaustion was high in teaching and research hospitals
- Desensitization was high in research hospitals

Murat Anil et al

The evaluation of burnout and job satisfaction levels in residents of pediatrics

Turk Pediatri Ars 2017; 52: 66-71

DOI: 10.5152/TurkPediatriArs.2017.4982
The Medical Prevention Model

• Vaccines
• Mammograms
• PSA tests

• Prevention in medicine is largely about early detection
A Primary Medical Blind Spot: The Self-Regulation Regime / The Systems Perspective

• The Disregulation Cascade
• Dynamic nature of mental disorders
• Progressive nature of certain conditions:
  • PTSD
  • The dementias and Parkinson’s
The General versus the Specific

• ‘Cerebral Global Function’ (Hughlings Jackson)
• General Adaptation Syndrome (Hans Selye)
  • HPA Axis
  • Cognitive domain
  • Core regulation

• These conceptions hint at an over-arching ‘quality of functioning’ that cuts across functional domains
Toward a systems perspective: Control systems theory

Hierarchy of Regulation:
- System stability
- System excitability/reactivity
- Continuity of functioning
- State regulation – analog domain
- Responsiveness to challenge
- Memory

These qualities cut across functional domains
Neural Network Integrity

Exogenous influences:
Gut-brain interactions; pharmacological interventions; cardiovascular constraints

Endogenous Factors:
Altered Functional Connectivity
Maladaptive plasticity
Episodic failure
The Regulatory Hierarchy

- Executive Function
- Cognition
- Motor planning
- Motor Activation
- Sensory Systems Excitability
- Arousal
- Affect Regulation
- Somatic Biofeedback
- Interoception
The Regulatory Hierarchy

Arousal

Affect Regulation

Somatic Biofeedback

SMR/Beta Neurofeedback

Executive Function

Cognition

Motor planning

Motor Activation

Sensory Systems Excitability

Interoception
The Regulatory Hierarchy

Arousal

Executive Function

SMR/Beta Neurofeedback

ILF Neurofeedback

Cognition

Motor planning

Motor Activation

Somatic Biofeedback

Sensory Systems Excitability

Interoception
Neurofeedback and Biofeedback over the Lifespan

- ILF Training
- Somatic BF
- Alpha-Theta
- Synchrony
- Conventional EEG band NF

Infancy | Childhood | Adolescence | Adulthood | Aging | Facing Death
ILF Neurofeedback in infancy

“This was a very colicky baby, with severe constipation and poor sleep, who would cry inconsolably for hours and hours in a row. She calmed down in her very first session, and stopped crying 18 minutes into it. Sleep improved and constipation resolved. I trained T4-P4 at whatever the lowest frequencies were back then.”

• Statement of the mother, a neurofeedback practitioner
Male age 12-13 “Difficult child”

- In the following case, consider what might have been done for this child within the existing medical model.
Prior history: Age 12 July 2017 start

• Difficult child physiologically—colic, high fever after birth
• Gut function issues; emotional volatility; behaviorally difficult; thrill-seeking
• Sleep disregulation; frequent waking (19-22/night); night sweats
  • Needs ten hours of sleep; difficult to wake in the morning
• After a massive fall down uneven steps at age 5, went from well to sickly over a few years. He had yellow skin and “floppy” tone; struggled with irritable bowel and severe asthma
• Poor fine motor skills; cramped, labored handwriting
Mother’s appraisal

• Smart, but not doing well at school.
• All came to a head with higher expectations of high school
• Mother has done all sorts of therapies for gut health...
• He’s frustrated, angry, oppositional
• Functionality variable....
  • Function varies with sleep, stress, diet, sugar craving
After the first twenty sessions of ILF NF:

- Feels more awake
- More able to accept correction
- Making better decisions (in opinion of mom and of self)
- Needing less sleep—more refreshed in AM.
- Still some difficulty falling asleep
- Math is easier
- Boring tasks are better tolerated
- Sugar craving reduced
- Better delayed gratification
- Calmer
- Hugely better with anger
- Happier, excited about life....
Mother’s appraisal

‘Before’ Status:
• ...verbalised things like “Everyone is always picking on me;” “I hate my life;” “I try to be good but it falls out of my head.”

After 20 sessions:
• ... first 20 sessions at EEG were solid, with a clear improvement.
• Sense of humor returned.
• He expressed “feeling loved.”
• He perceived this as other people changing:
  • “[Sister] Samantha is so nice now.”
After forty sessions total -- 20 at home

- Falling asleep more easily; more rested in AM
- School work is easier, less frustrating; grades much improved
- Increased creativity and music ability
- Teacher e-mailed mom about his amazing progress
- Mom: “The most remarkable change in ___ is his optimism. He sees and assesses the world positively. He has swapped a self-confirming negative bias for a self-perpetuating upward bias. He has broadened his friendship base. He no longer sees his peers as potentially threatening. He feels well liked and secure in his place at school. You can see he is happy in his being.”
Reports after 20 more sessions at EEG Institute

- Major improvement in consistency (variability) on the QIKtest
- Falling asleep more easily
- Feeling more rested in the morning
- More optimistic and confident
- Encountered gut problems with local diet during the training...
- Handwriting is still child-like and effortful...
- Tried to add LH for exec function but not yet well-tolerated
<table>
<thead>
<tr>
<th>Results</th>
<th>Data</th>
<th>Norm</th>
<th>Score</th>
<th>Percentile</th>
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<td></td>
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<td>38 %</td>
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<td>94</td>
<td>33 %</td>
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<td><strong>M12.8 Total Test</strong></td>
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<td>5.0 errors</td>
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<td>87 %</td>
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<td>&gt;119</td>
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<td>3.6 errors</td>
<td>&gt;121</td>
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<td>50.9 ms</td>
<td>95 ms</td>
<td>135</td>
<td>max</td>
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</tbody>
</table>
Slow period (#5):
Response Time Histogram - Totals
Mean of Test 447 ms
Norm 411 ms
Outlier Responses >870ms

Response Time Histogram - Totals: COMMISSIONS & ANTICIPATORY
Mean of Test 298 ms
Norm 411 ms
Outlier Responses >870ms

Response Time Histogram - Totals
Mean of Test 347 ms
Norm 397 ms
Outlier Responses >835ms

Response Time Histogram - Totals: COMMISSIONS & ANTICIPATORY
Mean of Test 307 ms
Norm 397 ms
Outlier Responses >835ms
61st percentile

82nd percentile

88th percentile
A case of pervasive psychological and physical trauma

• History of at least two concussions, major trauma, major depression, memory issues, extreme visual and auditory sensitivity, and bipolar-like symptoms.

• 3 sessions a day, 4 days a week for three weeks.

• Hypervigilance meant she could not tell how her body was reacting to the training.

• That presented difficulties in finding the optimal training parameters.

• Consequently, we did not get the ORF until the third week.
Figure 1. Time series of reaction times for the high-demand periods, pre-training.
Figure 2. Stacked chart of the discrete errors for each of the three tests.
Figure 3. Percentile scores for the top-level categories of accuracy and performance for the three tests.
<table>
<thead>
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<th>Percentile</th>
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<td>Median of Distribution</td>
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<td>56</td>
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<tr>
<td>Omission Errors</td>
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<td>109</td>
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<td>Response Time</td>
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<td>70 %</td>
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<tr>
<td>Variability</td>
<td>56.7 ms</td>
<td>62 ms</td>
<td>114</td>
<td>81 %</td>
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</table>
Figure 4. Chart of standard scores for the top-level categories and the subsidiary scores for the three tests. 100 is the norm; 15 is the standard deviation; and 145 is the highest permissible score allowed under the test.
Time series of reaction times for the high-demand periods, for the third test, taking place after 56 sessions.
Figure 6. Pre- and post- response time histogram for the total test, including both high-demand and low-demand segments.
Summary of the data

• With respect to the summary categories of Accuracy Index (based on the discrete errors), and the Performance Index (based on the continuous variables, mean RT and variability):
  • Progress went from the 1st percentile to the 99th in terms of the Accuracy Index
  • Progress went from the 2nd percentile to the 82nd in terms of the Performance Index
  • ILF Neurofeedback had been the only intervention
Figure 7. Symptom tracking chart, reflecting progress as assessed with a Likert scale of 0-10 for each symptom category.
Summary and Conclusion

A major failure mode has been overlooked by the field of medicine:

- Neural network relations in all of their aspects
- “Dynamic Functional Connectivity”
  - Under resting conditions
  - Under conditions of challenge
  - Under conditions of duress
- Self-regulation is the only viable remedy
  - Good regulation cannot be outsourced to any other agency
- The field of Medicine cannot bootstrap its way out of dysfunction without reliance on self-regulation technologies
A major shift toward prevention and health maintenance is called for

• “The optimal subjects in whom to intervene therapeutically are those who are destined but not yet manifest.”
  • C.R. Jack, The Living Brain and Alzheimer’s Disease, 2004

• That happens to include all of us!
Discussion