

Heart Rate Variability (HRV) Biofeedback for Beginners

What Do We Train?

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HRV Biofeedback: What Do We Train?

- I. Training for Optimal Breathing
 - Practitioners teach mindful, diaphragmatic breathing
 - Biofeedback displays the process of breathing, the rate of breathing, and the amplitude of breathing
 - *Trainee pursues smooth, even breathing, with large amplitude and low rate*

HRV Biofeedback: What Do We Train?

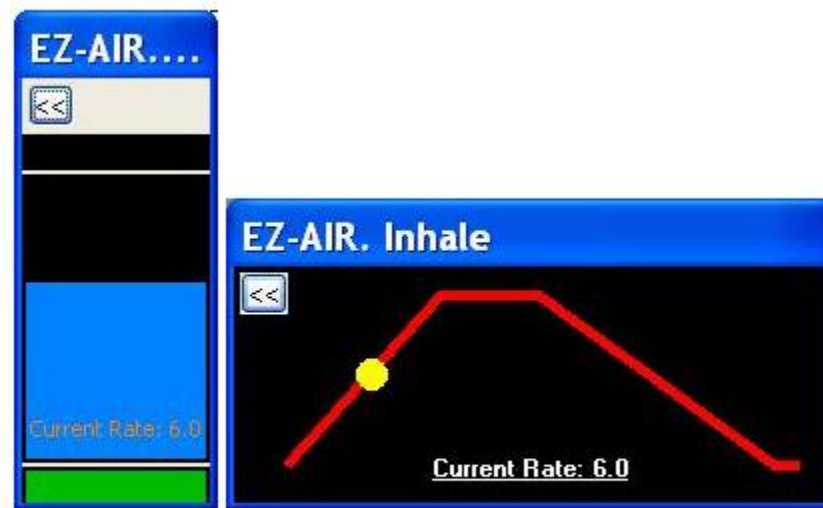
- II. Training for Resonance Frequency Breathing
 - Practitioners assess breathing at 4.5, 5.0, 5.5, 6.0, 6.5, and 7 breaths per minute
 - The Resonance Frequency is the breath rate producing the largest HR Max - HR Min, the largest SDNN, the largest pNN50

HRV Biofeedback: What Do We Train?

- II. Resonance Frequency (cont.)
 - The Resonance Frequency is the breath rate bringing heart rate and respiratory curves into phase, so that the peak heart rate, and the end of inhalation occur at the same point
 - *Trainee pursues breathing at Resonance Frequency*

Training Resonance Frequency Breathing

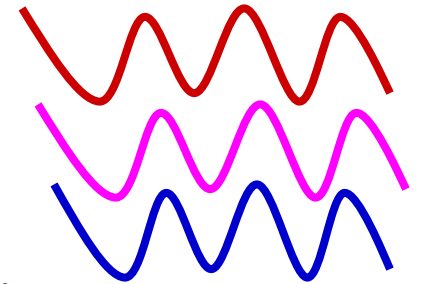
- *Utilize the EZ-AIR PLUS downloadable at www.bfe.org*



[Download Breath Pacer "EZ-AIR PLUS"](http://www.bfe.org)

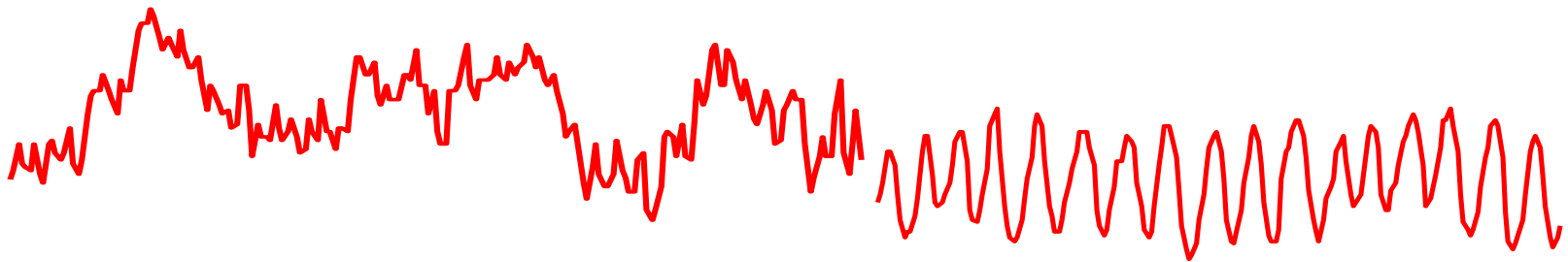
HRV Biofeedback: What Do We Train?

- III. Training for Smooth Physiological Oscillations
 - Trainees produce familiar phasic relationship of heart rate variations with respiration
 - Heart rate variations become more orderly or “*coherent*”
 - *Trainee pursues smooth, curvilinear, sinusoidal variation*



Training Coherence in Heart Rate Variation

Trainees visually recognize the difference between smooth sinusoidal variation when variation in heart rate is “coherent” and organized, versus jagged erratic variation in less organized variation.

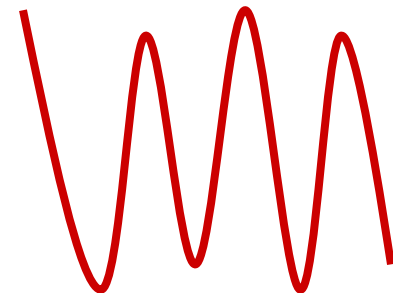
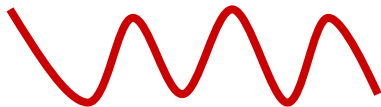


HRV Biofeedback: What Do We Train?

- IV. Training for Magnitude of Variation in Heart Rate
 - Biofeedback can reward for increases in the HR Max - HR Min
 - *Trainees pursue increased magnitude of variability*

HR Max-HR Min: Common Index in Biofeedback Training

- HR Max-HR Min: What is the difference in Beats per Minute (BPMs) from the highest HR and lowest HR in one respiratory cycle
- HRV biofeedback can signal each time this Index increases above a threshold
- Training can produce HR Max-HR Min amplitudes of 20-50 BPMs



HRV Biofeedback: What Do We Train?

- V. Training for Spectral Distribution
 - Using the FFT, various forms of spectral feedback can be given
 - Biofeedback rewards for shifts into the Low Frequency range of HRV via direct observation of 2D or 3D spectral displays
 - *Trainees pursue spectral shifts*

Spectral Training Criteria

- V. Spectral Feedback (cont.)
 - Rewards for increasing Per Cent Power (or Per Cent Amplitude) in LF range
 - Rewards for creating unimodal spike of HRV activity at about 0.1 Hz (Peak Frequency and Amplitude of Peak Frequency)

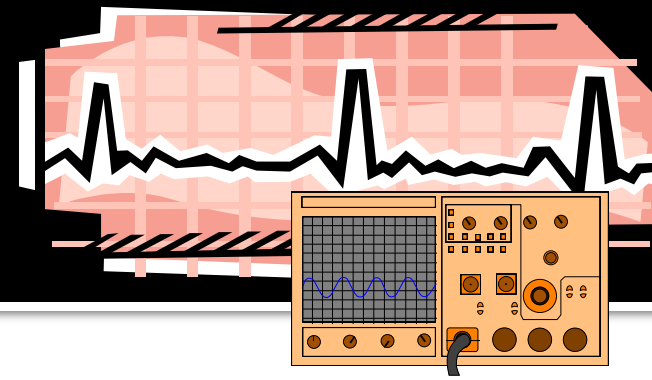
Spectral Training and the emWave



- HeartMath training, using the handheld emWave or the emWave Desktop, is spectral training
- High coherence is a state in which maximal variability occurs at approximately 0.1 Hz



Value of Multiple Training Strategies



- Two trainees produced apparently identical smooth sinusoidal respiratory curves, with sharply different heart rate variability
 - HR Max - HR Min
 - Subject 1 – 3 beats per minute
 - Subject 2 – 17 beats per minute

HRV Biofeedback: What Do We Train?

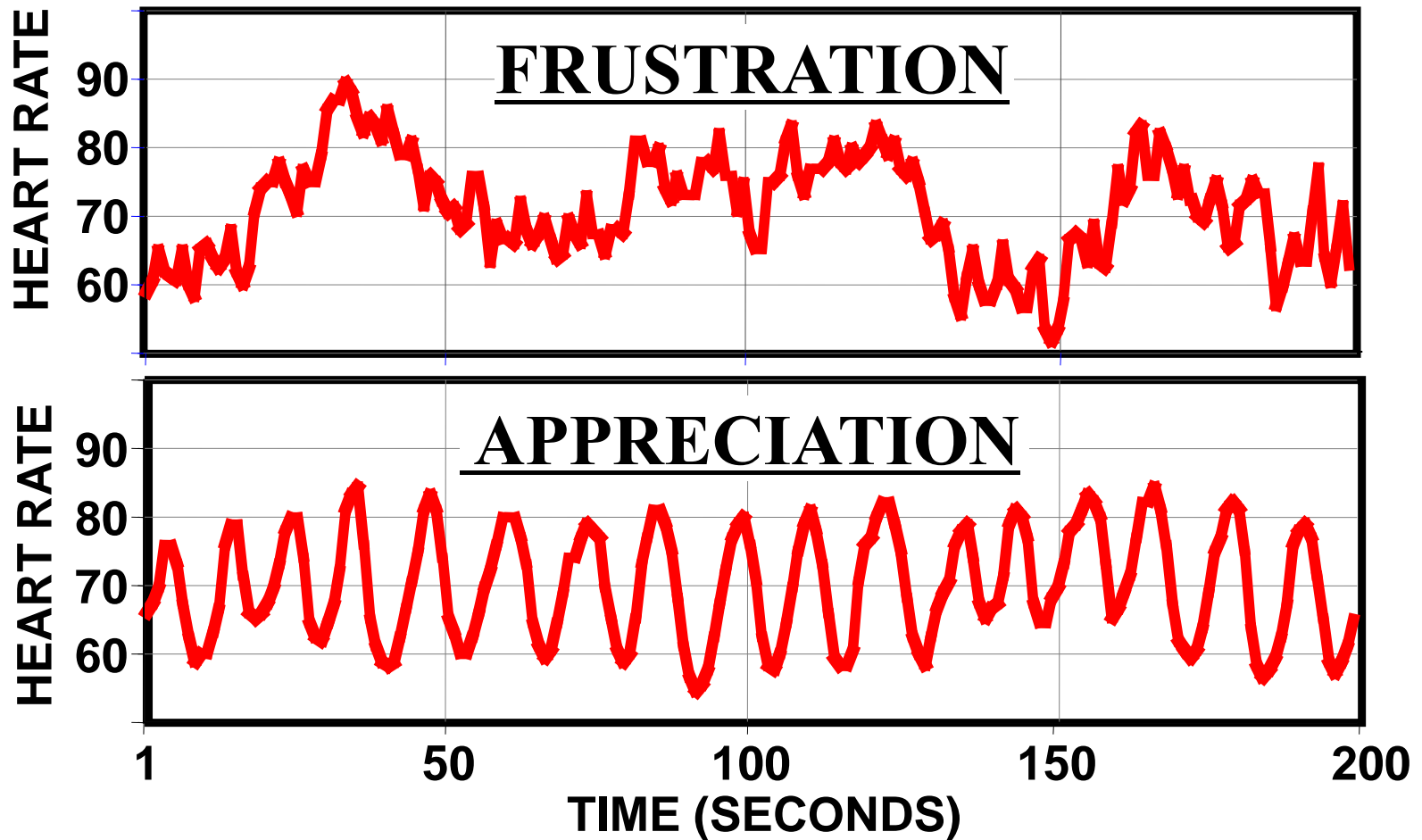
- VI. Training for Relaxation
 - Some subjects find explicit training to change physiology distracting
 - During hypnotic induction, autogenic training, or imagery exercises, many of the subjects show increased coherence, increased magnitude of variation, and spectral shifts
 - *Trainees pursue subjective relaxation*

HRV Biofeedback: What Do We Train?

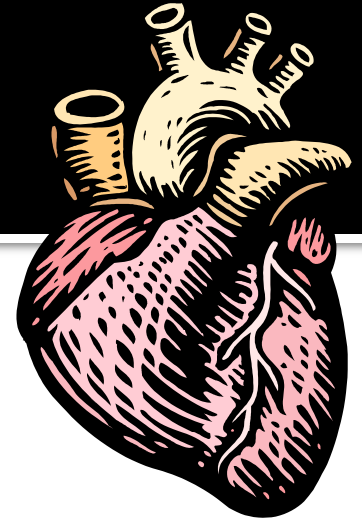
- VI. Training for Positive Emotion
 - Heart Math emphasis on cultivating positive emotion, and decreasing negative emotion
 - Operationally the biofeedback displays show the same parameters
 - Naras Bhat calls this the "Mother Theresa Effect"
 - *The trainees pursue warm appreciation, "loving kindness," and generally positive feelings*

“Emotions are Reflected in Heart Rhythm Patterns”

[taken from Heart Math Institute]



Hostility and the Pumping Heart



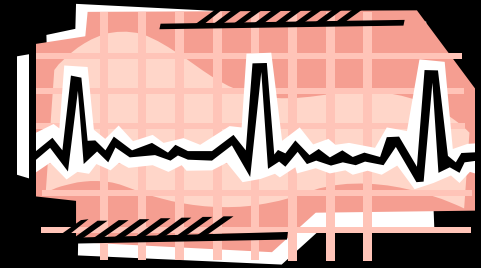
- Dr. Ironson (Miami University) -- remembering anger decreases the ejection fraction of heart
- The heart pumps less effectively when the person is angry

Anger Sends Clogged Arteries into Spasm

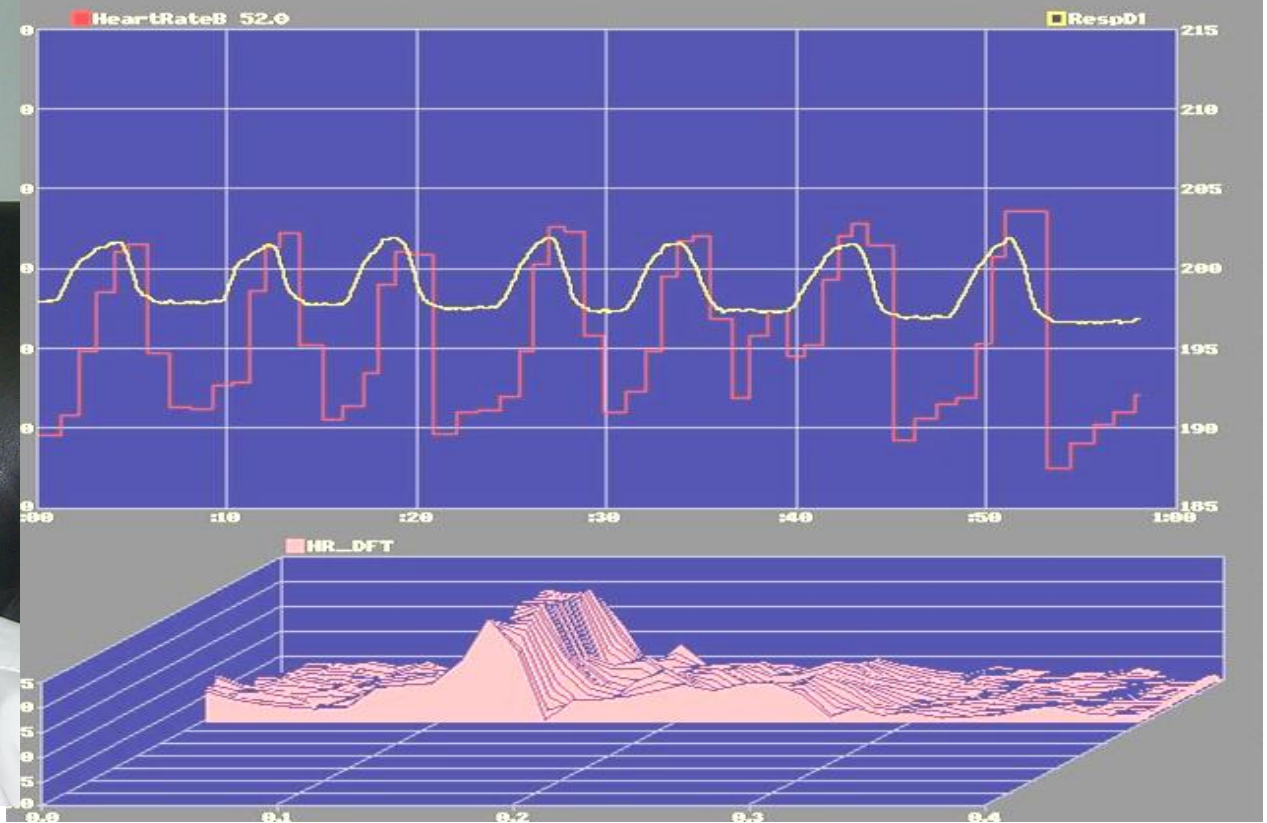


- Dr. Boltwood (Stanford University, 1993)
- Remembering anger produces spasm in arteries with atherosclerosis

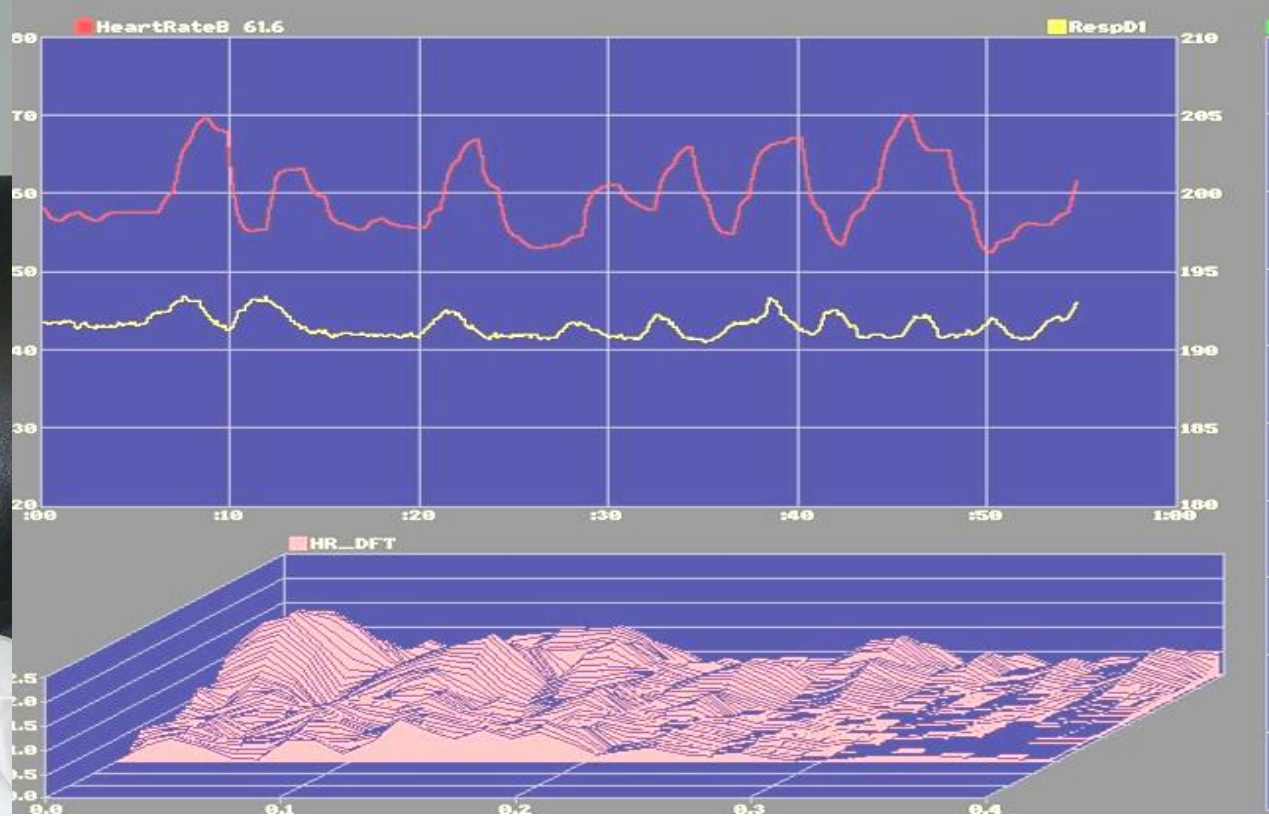
Anger and Negative Emotion Disrupts Orderly Rhythms in the Heart



- The human heart rate varies constantly
 - Healthy biological systems show large oscillations/variation
- Depression reduces heart rate variability
- Negative emotions such as anger create disorganized heart rate variation
- Positive emotions—“heart-felt emotions” are hypothesized to create coherent and harmonic variations in heart rhythms



According to a report from Naras Bhat (1999), when a person engages in a heart-felt emotion such as altruism, the HR variability synchronizes with breathing. In this spectral analysis, the FFT consolidates into a single peak at about 0.1 Hz.



According to Bhat (1999) HRV is more erratic when a person is engaged in "head-felt" negative emotions such as anger. His example shows less synchrony between HR and breathing, and several scattered peaks in the FFT. [Bhat, 1999, *Biofeedback Newsmagazine*, 27(4)].

Open-Heartedness

- The capacity to be emotionally available to experience the initial stages of connection with another
- The capacity to stand outside of one's ego long enough to emotionally touch and be touched by another
 - Brian MacLean (2004)

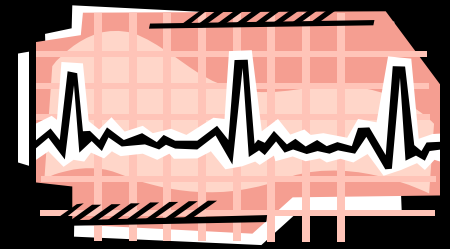


The Poet's View

- “It is only with the heart that one can see rightly. What is essential is invisible to the eye.”
Antoine De Saint-Exupery



Stay Tuned: Testing Heartfelt Emotion



- Does cultivating positive, heartfelt emotion really produce increased HRV?
- To date there is little empirical evidence!
- At the Baltimore AAPB meeting, Fred Shaffer and his lab will present a poster showing a study testing the impact of heart felt emotion (HFE) on the following variables: HR Max – HR Min, pNN50, RMSSD, SDNN, and LF/HF power.
- Stay tuned for the full results (but don't expect any evidence for an empirical effects of HFE).



Moss, 2011