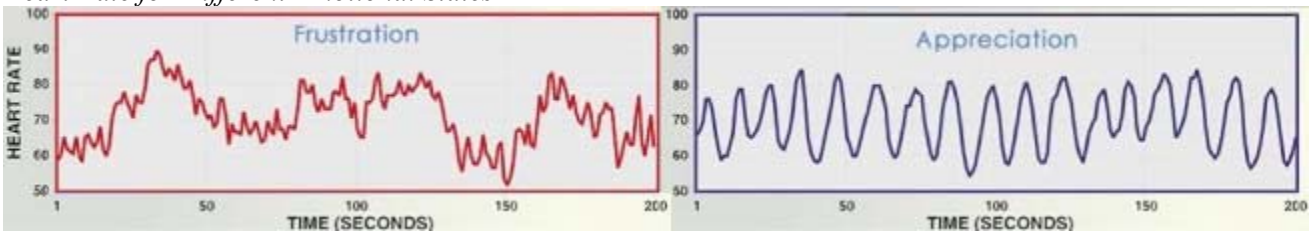
Regulating Emotions through Slow Abdominal Breathing

Emotion dysregulation describes when emotional reactions occur too frequently, intensely, or last too long, which can occur when a person faces stressful life events, is highly emotionally sensitive, or has difficulty tolerating their emotions. Many emotions can become dysregulated including anxiety, worry, fear, shame, sadness, anger, and the emotions persist or worsen when the person is not able to effectively control their emotional reactions. States of emotion dysregulation occur when the sympathetic nervous system becomes excessively active in combination with reductions in the activity of parasympathetic nervous system. Excessive sympathetic nervous system activation is often described as the "fight or flight" response, an alarm reaction similar to the startle response, when the body prepares for immediate self-protective actions by increasing breathing and heart rate, and changing blood pressure to divert blood flow to major muscle groups. Parasympathetic nervous system activation is the body's physiological emotion regulation response, which in many ways is opposite to the "fight or flight" response. When first facing a stressful event or possible threat, people normally experience an increase in the "fight or flight" response and a temporary reduction in parasympathetic activity. When the threat has passed, parasympathetic activity increases to help return heart rate, breathing, and other physiological functions to normal levels. The parasympathetic system of severely emotionally dysregulated people tends to turn off much more easily and take much longer to reactivate, which makes their emotions linger. Chronically low parasympathetic nervous system activity can also make people excessively emotionally reactive. In addition, the erratic and small heart beat fluctuations that occur with emotion dysregulation indicates that the sympathetic and the parasympathetic nervous system are out of sync with each other. This is similar to driving a car with one foot on the gas pedal (the sympathetic system) and the other on the brake (the parasympathetic system) at the same time, which creates a jerky ride, uses more fuel, and harms your car. The physiology of chronic emotional arousal can cause our body to operate inefficiently, deplete our energy, and strain our physical and mental health.

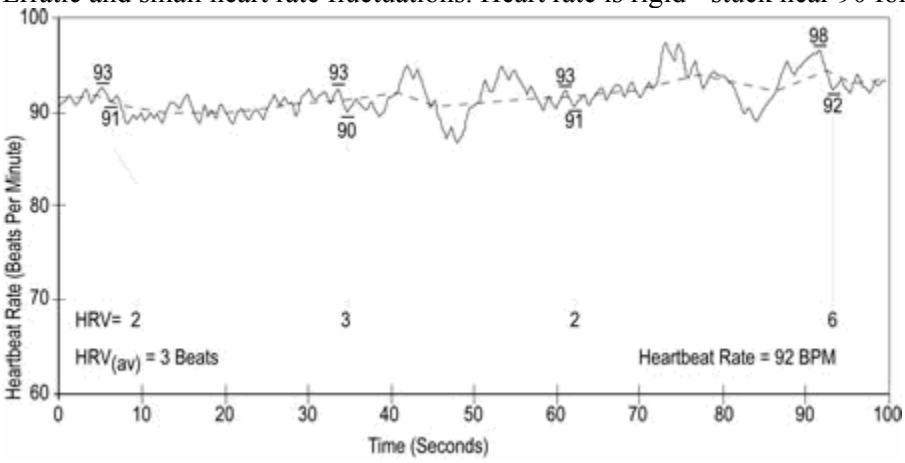
Heart Rate for Different Emotional States



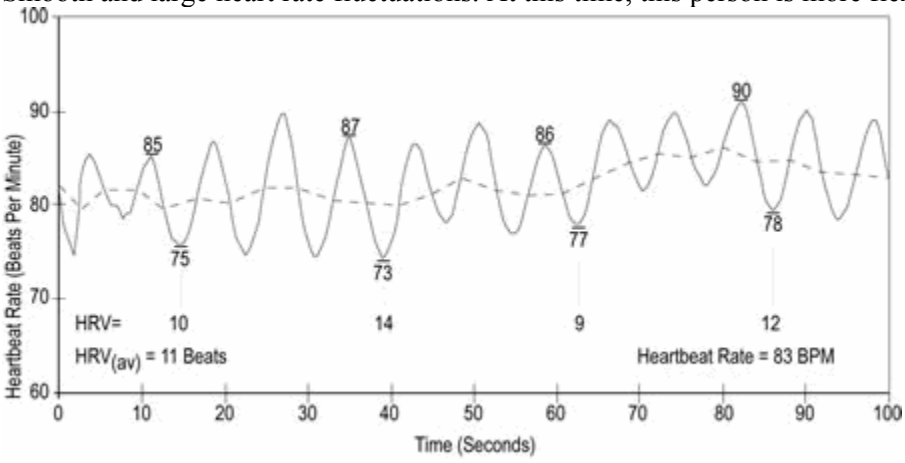
The two heart rate graphs differ in the smoothness of the heart beats fluctuations and how tall the waves are (the size of the difference between the highest and lowest heart rates during each increase-decrease cycle).

Generally, during inhalation the heart beats faster and during exhalation the heart slows down. For example, during a typical resting state an average person has a peak of 85 beats per minute (bpm) during inhalation and 75 bmp at the slowest rate during the exhalation, a difference of 10 bpm. When the parasympathetic nervous system is more active, this inhale-exhale difference in heart rate and blood pressure increases, and breathing slows down. People who have a relatively larger inhale-exhale difference in heart rate are more adaptable, regulated, flexible, physically healthy, and have more ability to control their behavior and persist in effortful behaviors.

Emotion Dysregulation and Fast Breathing
Erratic and small heart rate fluctuations. Heart rate is rigid - stuck near 90 for this person.



Emotion Regulation: Increased Parasympathetic Activation and Slower Breathing
Smooth and large heart rate fluctuations. At this time, this person is more flexible and adaptable.

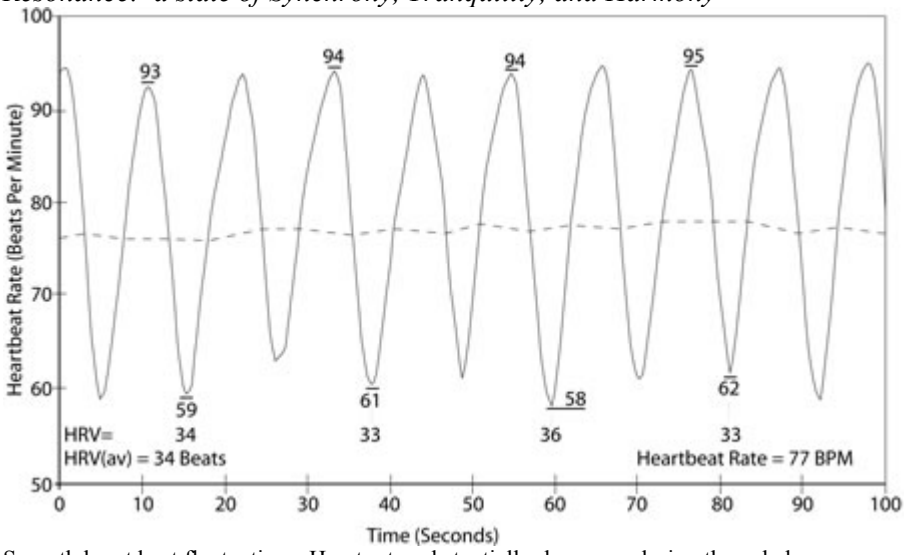


Not only is breathing pace *caused by* sympathetic and parasympathetic activity, but it is also true that breathing pace *causes* changes in sympathetic and parasympathetic activity. Many people habitually breathe rapidly, shallowly, and in the chest, which is often accompanied by episodic breath holding, sighs, and gasping. This breathing pattern is often subtle and chronic, resulting in increased heart rate, blood pressure, gastro-intestinal distress, asthmatic symptoms, neck and shoulder tension, anxiety and emotional arousal, and even increased risk of heart attacks.

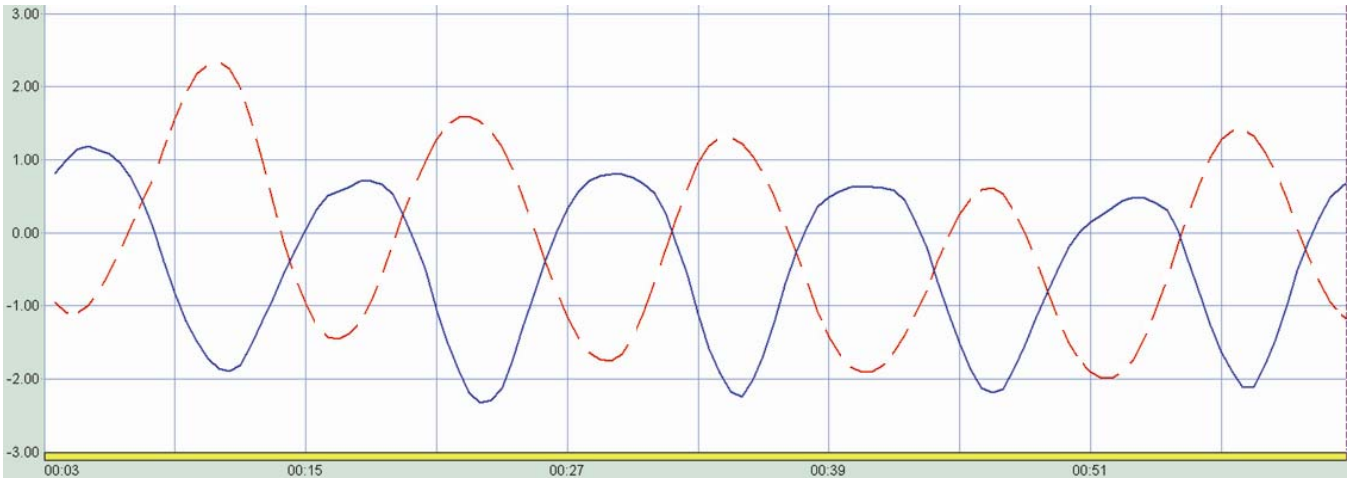
Thus, one effective strategy for reducing emotional arousal and stress is *resonant frequency* slow abdominal breathing. Breathing normally occurs at a rate of approximately 8-10 breaths per minute. Slowing breathing to approximately six breaths per minute (one complete breath cycle lasting 10-12 seconds) is effective at reducing emotional arousal by activating the parasympathetic nervous system. Not only does parasympathetic activity slow down breathing, but it is also true that slowing breathing also increases parasympathetic activity. Specifically, slow breathing increases heart rate variability linked to breathing, such that the peak heart rate during the inhalation could be as high as 95 beats per minute (bpm) while the slowest rate during the exhalation being as low as 60 bmp (a difference of 35 bpm). Slow breathing also increases the inhale-exhale difference in blood pressure. Improved parasympathetic functioning and blood pressure regulation are likely to persist beyond breathing sessions when slow breathing creates the largest possible inhale-exhale differences in heart rate and blood pressure. Breathing at a slower rate also increases the smoothness, or *coherence*, of heart rate fluctuations from breath-to-

breath, and the synchrony, or *resonance*, among breathing, heart rate fluctuations, and blood pressure fluctuations. When this synchrony occurs, the peak of the inhale occurs at almost the exact same moment as the peak of the heart rate increase and the lowest blood pressure. Coherence and synchrony are important indicators of autonomic nervous system balance and overall emotional and physiological harmony. Optimal slow breathing results in lowered blood pressure and heart rate, a decreased sweat response and a general sense of peace and wellbeing.

Resonance: a state of Synchrony, Tranquility, and Harmony



Smooth heart beat fluctuations. Heart rate substantially decreases during the exhale.



Synchrony between fluctuations in heart rate (solid line) and blood pressure (dashed line). At resonance, the peak of the inhale occurs at almost the exact same moment as the peak of the heart rate increase and the lowest blood pressure.

Optimal breathing rate, known as the *resonant frequency*, varies among individuals, and breathing at the resonant frequency has a much greater psychological and physical health benefit than breathing at a rate even slightly slower or faster. Optimal breathing rate ranges from 4.5 to 7.0 breath cycles per minute. Overall, shorter people and women have an optimal breathing rate that is faster than for taller people. For example, the ideal rate for people five feet tall is about 6 breaths per minute, on average (ranging between 5.4 and 6.4 breaths per minute), whereas for people six feet tall the optimal rate is about 5.3 breaths per minute (ranging between 5.0 and 5.7). The ideal way to find the precise optimal breathing rate for an individual is to use biofeedback equipment to identify the precise breathing rate that maximizes coherence and the inhale-exhale difference in heart rate. Then the client should practice daily breathing at the

resonance frequency using a breathing pacer like the E-Z Air or free audio pacers available at www.dbtsandiego.com/current_clients.html. Between-session practice can be assisted with affordable and easy-to-use biofeedback equipment such as EmWave (by HeartMath company), which installs on a regular personal computer and detects heart rate via an ear-clip sensor, or portable biofeedback devices such as the StressEraser (by Helicor company). With each breath, the patient sees on a computer screen the size and smoothness of the heart rate changes that occur with each breath, and learns to repeat the most effective breaths. The client should practice slow breathing for at least 20 minutes per day.

Optimal breathing is also involves breathing from the abdomen, relying entirely on the diaphragm muscle, without moving the chest. It is often useful to practice by lying down on one's back, placing a book on the abdomen, near the bellybutton, and during the inhalation, lifting up the book. During the exhalation, the pressure of the book pushes the abdomen back down. The air should be allowed to flow evenly and slowly, and when attention drifts, the client should return to observing the breath and the movement of the abdomen. There is also evidence that emotion regulation is enhanced further when the exhalation time is about twice as long as the inhalation time. Thus, for many people the ideal breathing pace is for the inhalation to last about four seconds and the exhalation to last about 6-8 seconds.

Resonant frequency slow breathing is different than most techniques for relaxation. At the physiological level, relaxation is characterized by an overall reduction in nervous system activity, resulting in a reduction in both heart rate and the inhale-exhale difference in heart rate and a dominance of parasympathetic activity. Resonant frequency slow breathing is also associated with a dominance of parasympathetic activity, thus encompassing a key element of the relaxation response, but is physiologically distinct from relaxation in that it results in an *increase* in the inhale-exhale difference in heart rate, and its fluctuations are synchronized with other body functions such as blood pressure and breathing. This can be likened to driving a car and smoothly alternating between smoothly applying the gas pedal (the sympathetic nervous system) and then the brake (the parasympathetic nervous system) to respond to traffic conditions with smooth responsive driving. In contrast, relaxation is like smoothly alternating between applying minimal gas and minimal breaks, when going that slow would not be effective in a busy traffic environment. Not only are there fundamental physiological differences between resonance/coherence and relaxation, but the psychological characteristics of these states are also quite different. Relaxation is a low-energy state in which the individual rests both the body and mind, typically disengaging from thinking and emotional processes. In contrast, resonance/coherence generally involves the active engagement of positive emotions, and is experienced as a calm, balanced, yet energized and responsive state that is conducive to everyday functioning and interaction, including the performance of tasks requiring mental acuity, focus, problem-solving, and decision-making.

The Dialectical Behavior Therapy Center of San Diego provides a 10-session emotion regulation breathing training as an add-on to other forms of therapy, including standard Dialectical Behavior Therapy (DBT). The emotion regulation breathing training is compatible with all forms of therapy, including psychodynamic therapies. During the first session the resonant frequency breathing pace *for the individual* is found. The next several sessions focus on coaching the individual to maintain the optimal breathing pace, breathing from the abdomen in a smooth and focused manner, without relying on a breathing pacer. Heart rate variability biofeedback is utilized to provide personalized feedback about how exactly to breathe to maximize heart rate variability and synchronize breathing with the natural rise and fall of each heart rate cycle. In the final sessions, the breathing coach assists the patient in practicing slow breathing self-regulation in the presence of emotion triggers, for example, by having the patient practice after focusing briefly on distressing phrases, thoughts, or mental images. The primary therapist (generally not the breathing coach) should then help the client practice in increasingly stressful and emotional situations in and out of therapy sessions.