



Hello all,

Welcome to *Swan & Stone, Volume 1, Issue 5, The Wave*. I hope you enjoyed my last article, [The Mechanics Of Resonance](#). In this issue, we'll look deeper into the wave generated by breathing and examine its surprisingly sinusoidal character. As introduced in previous issues, the sine wave is a fundamental signature of vibration in nature, e.g. a pendulum. It was also posited that the human cardio-pulmonary-circulatory system demonstrates resonance, not unlike other physical systems, the signature of which is a sine wave. Figure 1 compares the sinusoidal Valsalva Wave (red) with a mathematically generated sine wave (blue). I've superimposed the blue wave on the Valsalva Wave record for purposes of comparison. Here we can see that while the Valsalva Wave is slightly variable in time (the frequency is varying to a small degree), it is a near perfect sinusoid.

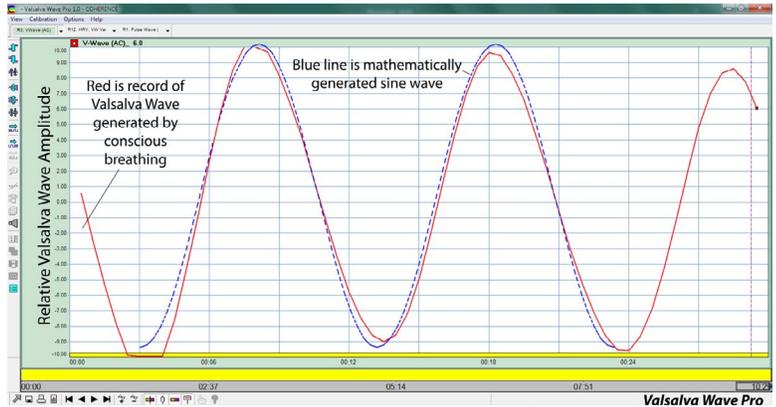


Figure 1: The Valsalva Wave compared to a mathematically generated sine wave. The Valsalva Wave is red. The sine wave is blue.

For interest, the Valsalva Wave of Figure 1 has the highest amplitude of any Valsalva Wave that I have on record, with over 3% variability (See Figure 3). While we're detecting blood density, this is analogous to 3 foot waves on a body of water that is 100 feet deep. Typical Valsalva Wave variability is <1%. This wave was recorded at the right earlobe while seated, using instrumented Coherent Breathing *combined* with nutrition and hydration. Average heart rate variability (HRV) during this record is 25 beats, i.e. not maximal.

But back to the matter of vibration and resonance... There is a critical difference between the resonant vibration of the human cardio-pulmonary-circulatory system and that of a crystal (for example), the difference being that the mind is an integral part of the human system. It is the mind that ultimately generates the signal that causes the diaphragm to move in the graceful sinusoidal pattern. The physical construct of the cardio-pulmonary-circulatory system including the thoracic and abdominal cavities support the physics, but it is the phrenic nerve emanating from the vertebrae of the neck that supplies both motor and sensory nervous functions for the diaphragm. "Phrenic" is a word of Greek origin (phren) having the twin meanings: "diaphragm" and

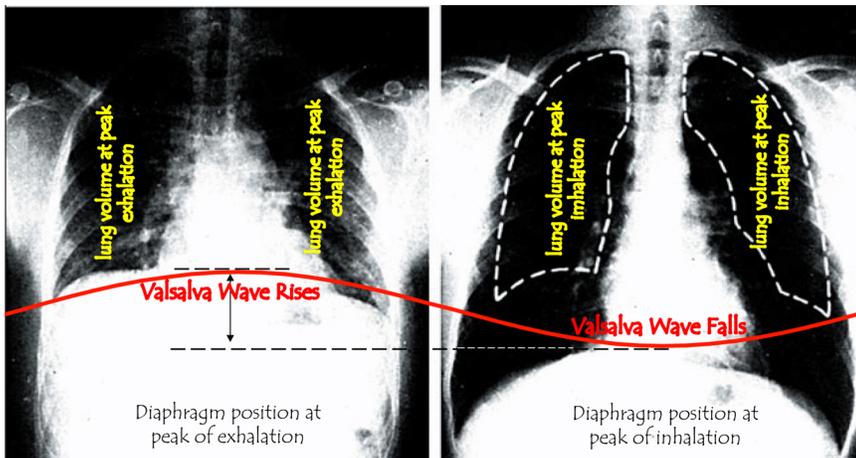


Figure 2: The wave is a function of the diaphragm. Diaphragm motion is a function of the phrenic nerve.

“mind”. There is little doubt that the ancient Greeks comprehended the significance of the relationship between the two. With this in mind, we might conclude that while we have resonant bodies, without mindful governance resonance is a fleeting matter. This same principle applies to posture and motion, both are potentially oscillatory and resonant but without mindful engagement, neither can be known. A goal of Coherent Breathing practice is to engram mindful diaphragm control; a goal of [Wuji Qi Gong](#) is to engram resonant posture; a goal of Tai Chi is to engram resonant movement; an eventual outcome is their integration.



But why worry about it? The answer is this... When the wave is synchronous and coherent, it serves as a sort of “master clock” signal which is communicated throughout the body via the movement of blood, cerebrospinal fluid, and lymph, and bio-electrically via the nervous system and energetic pathways. When synchronous wave action is present, other systems phase-lock to it. The stronger the signal generated by breathing, the faster and more precisely other bodily systems align. This is an example of chrono-biological entrainment, in this case, bodily systems synchronizing with a rhythm generated by the mind and exerted via the phrenic nerve. Things work to a master rhythm which we know includes the rhythm at which the brain is washed with a wave of blood, and extrapolating the findings of the research of [University Of Rochester Medical Center](#), by a wave of cerebrospinal fluid. So it may be that the mind, by asserting the master clock is looking after itself by protecting its physical foundation...the brain. There are many psycho-physiological correlates of breathing coherently and as I’ve said many times we can see multiple biometrics begin shifting in a desirable direction almost immediately, once Coherent Breathing begins. And there are qualitative differences that accrue from practice: a relaxed comfortable body, a quiet mind, a rational heart, free from fear and angst.

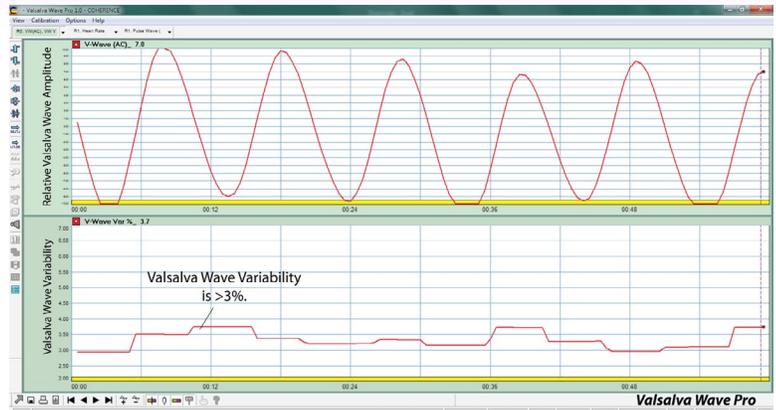


Figure 3: Big Valsalva Wave demonstrating variability >3%.

I’ve spent a good portion of 2015 studying, practicing, and contemplating the bigger picture significance of Coherent Breathing and the Valsalva Wave it produces. I’ve arrived at the basic conclusion that, while the science of breathing includes many interesting avenues, physical, mental, and spiritual, the most fundamental advantages to breathing well are *circulatory and digestive*. Here, I mean to say that cellular health of the physical body is dependent on diaphragm movement because it facilitates circulation, respiration, nutrition, energy production, waste elimination, and biologic regulation in general. Ultimately, every aspect of health is predicated on the cellular health of the organs, brain, bones, and tissues. As the mind is what the brain does (Steven Pinker), this ultimately includes mental health, which I see as closely related to cellular health. To this end, we are developing a *Coherence Protocol* for health, well-being, performance, and longevity:

***Coherent Breathing (Optimal Circulation) + Optimal Hydration + Optimal Nutrition***

When we breathe coherently, the mind facilitates circulation at all times, even when we’re not involved in what we normally think of as “exercise”. This is because conscious use of the diaphragm and muscles of breathing is a single unique and most important form of exercise that generates wave action in the body facilitating circulation and digestion. It is this wave action that moves nutrients through the organs of digestion, moves blood through the circulatory system, and washes the capillary circulation throughout the body, bringing nutrients and removing waste. It is a form of exercise that we are forced to use if we require the body to perform work, but that we have an option to use during daily life. It is a choice.

Stephen Elliott, President, COHERENCE

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