



Hello all,

Welcome to *Breathing & The Mind*, a romp through the field of possibility regarding how our movement of the diaphragm affects and influences our mind state and associated mental processes and outcomes.

Before we begin, I harken back to [Issue 13](#), where I invoked the term “understanding reality” and related it to “seeing the forest for the trees”. Here I will build on this argument – that a function of the mind, if not its foremost function is to perceive reality *as it really is* – that our perception is clear, and that our impression and interpretation of that reality are coherent, ultimately resulting in a reasoned and rational understanding and response. The fundamental capability of mind to perceive and act on a shared basis of reality has allowed humankind to arrive at this juncture of understanding of the world – of our civilization as we know it.

But we know that there are perils, that our very perception and impression of what we are perceiving can be (and is generally accepted as being) filtered by our prior experience and the paradigm that we “construct” through our personal experience, cognitive process, and resulting “beliefs”. In this way the very lens through which we perceive the world around us can be different. This is a reason that it is not uncommon for multiple observers to witness different accounts of the same event. When I was growing up, a discussion of current events was the frequent topic at the dinner table, providing an opportunity for sharing perspectives and sorting through the day’s reality with reason and logic, to some degree inevitably tempered by family values. In retrospect, this was us kid’s exposure to Critical Thinking 101, a skill and capability that we have been very deliberate about keeping and honing in our adult lives. As an engineer specializing in innovation, system design, and complex problem solving, it has been, to a large extent the basis of my career and source of income, including my last few decades as a life scientist. The job of any scientist is to understand reality – to accurately determine how things *really* are. In technological fields this is imperative, otherwise things don’t work and technological pursuit ends. Technology is ultimately built on fact, not opinion or conjecture. Theories however, are built on hypotheses – no theory ever being completely immune to eventually being proven wrong by a new discovery. Science progresses via theory and amassing evidence in support of theory. Technology advances on the basis of theory and the probability that theory is sound.

Here I propose to advance COHERENCE theory, an advancement for which there is already supporting hypotheses and a great deal of anecdotal evidence old and new, this being that:

“How we use our diaphragms is a large determinant of how our minds work.”

Here is the essential argument, starting with the theorem that “the mind is what the brain does”. (Pinker, Minsky, ?) The mind is the ethereal outcome of the processes carried on by the physical construct of the brain and central nervous system. The brain is an organ of the body carried above the chest (in upright body position) and is dependent on the physiology of the rest of the body to provide it with the environment in which to function. The entire science of EEG (electroencephalography) biofeedback is based on the premise that we are able to modify one’s life by modifying how our brain is functioning – the “life change” is a function of “mind change” facilitated via “brain change” facilitated by conscious interaction with one’s own brain function. Evidence tells us that movement of the diaphragm also facilitates brain change, almost instantly. It is posited that this is due to the circulatory consequence of moving the diaphragm, that each time we do move the diaphragm with depth and regularity, a large

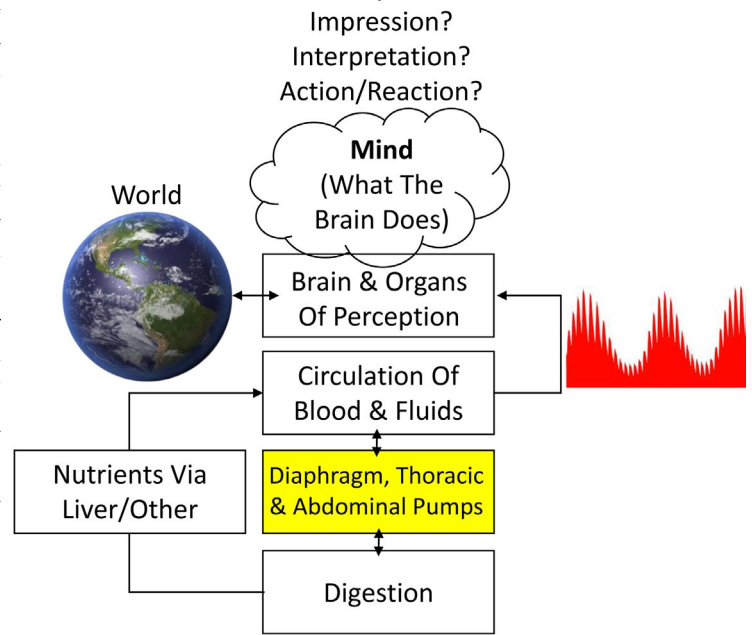
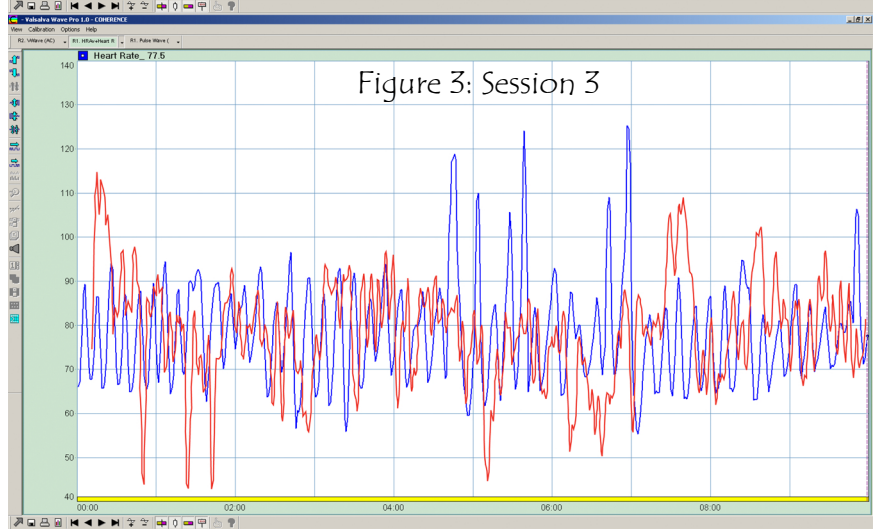
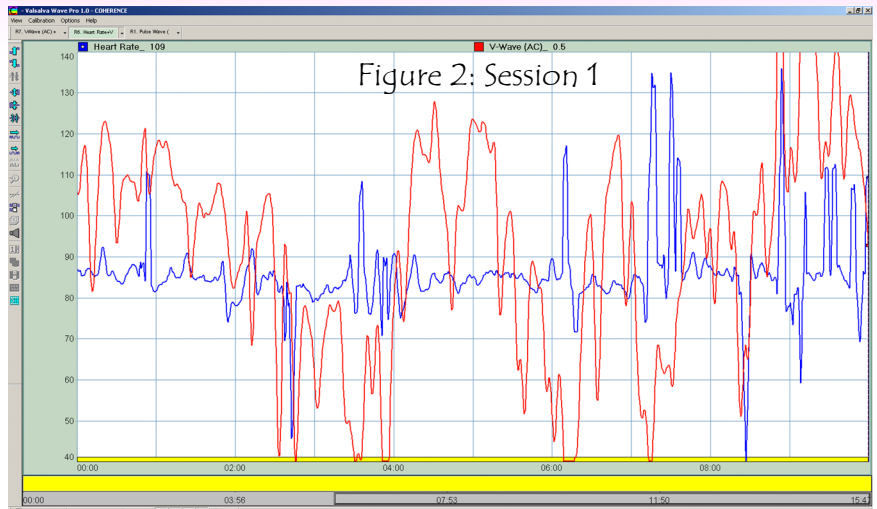


Figure 1: Breathing & The Mind



wave of blood is sent to the brain coincident with exhalation and drawn from the brain coincident with inhalation. We have observed this via both electroencephalography (EEG) and hemoencephalography (HEG). The amplitude of the wave in the brain as detected by EEG when one is breathing Coherently is ~10X that of the functional brainwaves that have been traditionally employed in EEG biofeedback training.

Much of *The New Science Of Breath* (2005) was devoted to the discussion of how breathing affects the autonomic nervous system, facilitating balance between sympathetic (activating) and parasympathetic (deactivating) functions by setting up a rhythm of balance, this rhythm swinging like a pendulum with every inhalation and exhalation. At that time it was not clear exactly why or how this occurred. In the 2nd Edition (2006), the theory was revised to incorporate the respiratory arterial pressure wave phenomenon, heart rate falling and rising as a consequence of the respiratory arterial pressure wave rising and falling – via baroreception. In 2013, the theory was again revised, this time by the discovery or realization that the brain experiences the respiratory arterial pressure wave directly. Prior to our research of 2011-2013, this was an open question, primarily because if the wave existed in the brain, it would be apparent via EEG, but it wasn't. But it kept coming back around, if brain state changed with a single 12 second cycle of Coherent Breathing, *then the brain must see the wave*, and we were not detecting it. It turned out that this was in fact the case, and that the reason we were not seeing it via EEG was because the “state of the art” EEG instrument was filtering out “low frequency physiologic noise” so as to allow the detection of the brainwave phenomena of interest, i.e. the functional bands including Beta, Alpha, Theta, and Delta waves. This is effectively the same thing we had done in 2009, i.e. remove the low frequency filtering from the state of the art heart rate variability instrument, which had been tuned to pick up the band of frequencies associated with the heart beat and the heart beat alone.



Accepting for now that the brain sees the Valsalva Wave, and that it responds by producing electrical waves with amplitude that is 10 times that of functional waves, consider the brain's reaction to the heart rate and Valsalva Wave of Figure 2 above (session 1) – which to my eye appears to be a mix of spurious noise and impulse noise. Figure 2 shows no evidence of any kind of cyclic diaphragm motion. Now compare Figure 2, to that of Figure 3 (session 3 - client well on the way to resonant breathing), and Figure 4 (me demonstrating resonance, recorded 10 minutes ago for this article).



Referring to Figures 2, 3, & 4, I would like to make a communications theory analogy between the human brain and a machine, where communication theory says that the information handling capacity of the machine, be it a computer or a channel, is fundamentally limited by its noise. This is because noise ultimately results in “errors” and is the reason that virtually all digital systems employ error detection and correction techniques. The question is, is the human brain and its outcome – the mind susceptible to this same physical phenomenon, “noise”, and I will argue that it is. As both the human body and brain are physical systems, and as noise is also a fundamental physical phenomenon, the human brain and its myriad operations functioning on the slightest of potentials, and its “information”, manifesting as the mind, has to be vulnerable to “biological noise” which again is the reason that low frequency phenomena was filtered out of EEG to start with, which occurred in the early days of EEG, those of Elmer and Alyce Green, considered pioneers in the field of human consciousness, along with others. But its important to remember that at the time, while the phenomenons of the respiratory arterial pressure wave and of its outcome, breathing induced heart rate variability, had been observed and documented (in Asia thousands of years earlier and by scientists in the US decades earlier), neither had been characterized or their significance understood, so it was natural to consider them “unwanted physiologic noise”, relative to the early inquiry into the very subtle signals of early EEG. *The slight problem is that this filtering was forgotten and the physiologic phenomenon that produced it was also forgotten.* As it turns out, it was at least as important as the phenomena of concern. This is true because the functioning of the brain depends on physiologic status. It can be argued that the reverse is also true, but the first relationship has precedence over the second. When the brain sees a coherent Valsalva Wave rising and falling, it modifies functional wave activity – high frequency Beta activity is reduced, Alpha & Theta activity is increased. Because it was forgotten, we’re finding it out 50 years later.

Returning to *The New Science Of Breath*, in the book we discussed the changes observed in clients in terms of changes in their “autonomic state” as assessed via instrumentation, but also their own perceptions regarding their own internal status, i.e. comfort, attention, thought, emotions, self-governance... their state of mind, which changed along with their autonomic nervous system biometrics. The premise is that changes brought about by their central nervous system via Coherent Breathing and biofeedback elicited changes in their state of mind – which is often the practical aim of the intervention to start with. Dee Edmonson, RN, BCIAC-EEG led this clinical research.

A common experience that Coherent Breathers report is that of “a strange sense of internal calm and quiet”. I am very familiar with this state, it is the state to which I aspire, all the time – circumstances permitting. Here I speak of placing the mind in “neutral”, the mind idling quietly, no internal dialog, no rumination, no contemplation – simply “being”. When the mind can rest in this state, with neurons and networks freed up, then one can perceive reality, especially if one has worked to keep their lens clean and clear of distortion. Secondly, one can rally one’s mental focus like a laser for study, practice, contemplation...open to intuition. I offer that this is the *coherent mind state* that results from Coherent Breathing. I think it likely that, the washing of the brain by the Valsalva Wave, when we are both erect and horizontal, helps keep our brain, our mind, our lens, clean and clear. I employ The Six Bridges practice every day, specifically for this benefit – to wash away the emotional rubbish and mind pollution that accrues on a daily basis.

New neural networks are being built and modified every second as a consequence of our environment and what we are engaged in doing. How we breathe, along with how we spend our time, along with the environment in which we spend it, along with hydration and nutrition, all combined, become a determinant of how neural networks in the brain are formed, and ultimately a determinant of the lens through which we see the world. Personally, I desire to exist in *a coherent natural world – one that is free of delusion wrought by man – a world with all the colors of the rainbow.*

Finally, referring to Figure 1, diaphragm movement contributes to this process in a number of ways: it generates the Valsalva Wave in the circulation, facilitating hydration, digestion, and nutrition. Flow and pressure differentials generated by the wave in the blood (5L) keep fluids throughout the body (37L) fresh and vital – including those of the brain.

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