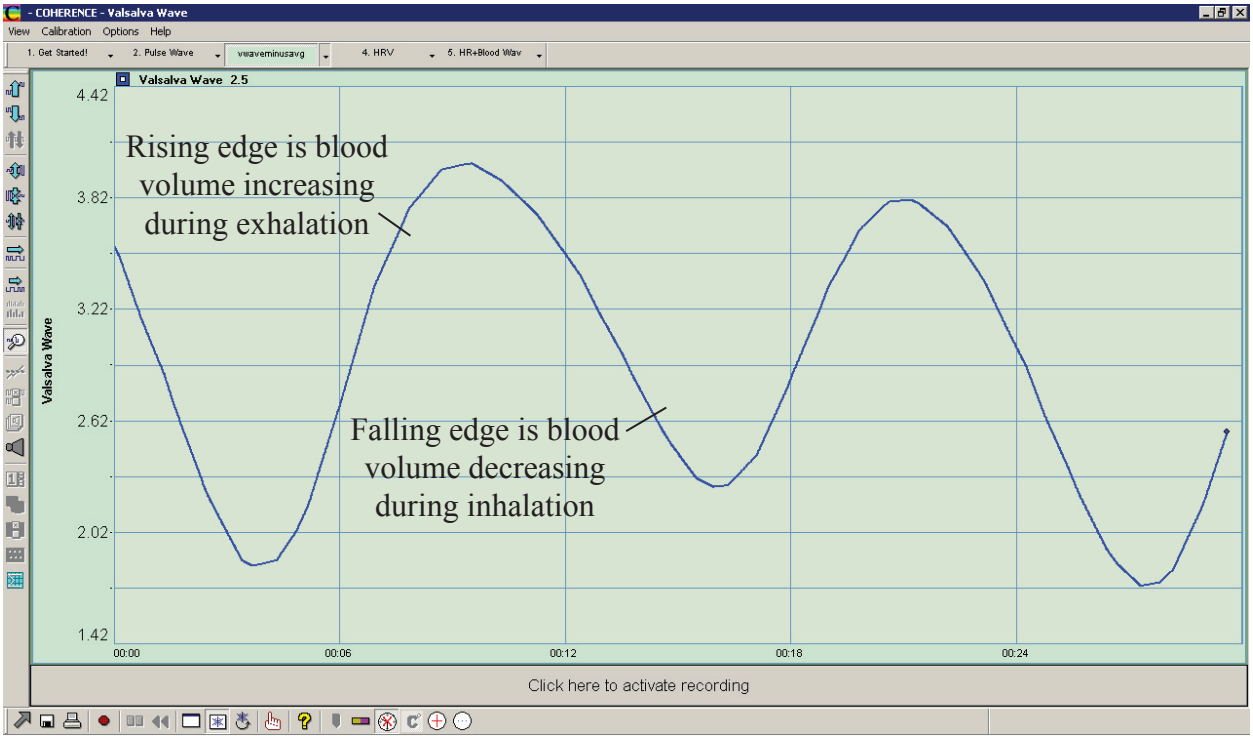
Hello all,

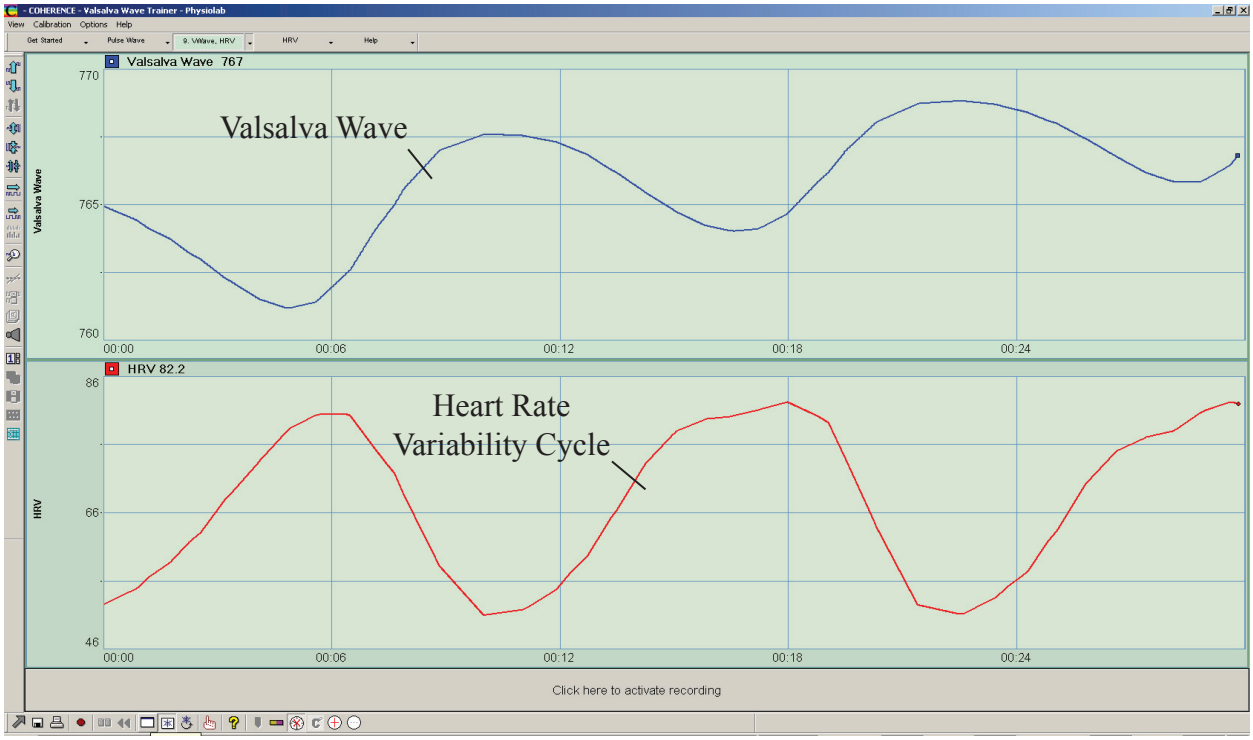
Welcome to the May ***COHERENCE Newsletter***. This month, I'm excited to preview "***Valsalva Wave"***, a new COHERENCE product that will be available shortly. But before we begin, I'd like to offer a last reminder that the workshop ***The Art and Science of Coherent Breathing*** (for therapists and clinicians) will be taking place in Chicago on June 19th. Its a one day event and there are still a few seats available. To find out more visit: www.coherentbreathing.org. Thank you for your interest. I'm also pleased to announce that Dee Edmonson and I will be presenting the workshop: ***The Valsalva Wave - The Changing Landscape of Heart Rate Variability Biofeedback*** at the ISNR 2009 Conference on September 3rd in Indianapolis. We hope to see you there.



The "Valsalva Wave"

Valsalva Wave is an instrument that allows us to observe and train a fundamentally new biometric, "blood flow", in this case in the thumb or finger, as a function of respiration. You may recall that when we breathe slowly and deeply, the lungs store and eject a large volume of blood with each cycle of respiration. This is a function of what I refer to as the "thoracic pump", assisted by the heart and vascular system under fine autonomic control. See ***Coherent Breathing - The Definitive Method*** for background. A small portion of this volume makes its way to the hands, and a smaller portion into each finger. The illustration presents blood volume monitored in the thumb for a few cycles of respiration. The basic signal is derived by measuring total *blood volume* in between heartbeats using a DC plethysmograph. The rising edge represents the thumb filling with blood during exhalation, the falling edge, the thumb emptying of blood during inhalation. The amplitude and coherence of the Valsalva Wave are largely determined by the depth and coherence of respiration.

Many of us are familiar with Heart Rate Variability (HRV). "HRV" refers to the change in heart beat rate, again, principally as a function of respiration. The HRV cycle is determined by measuring and plotting the inter beat interval or the *time* between heart beats. Once trained, the HRV cycle appears sinusoidal or wavelike. However, the HRV cycle is not an actual wave, i.e., it is an abstraction.

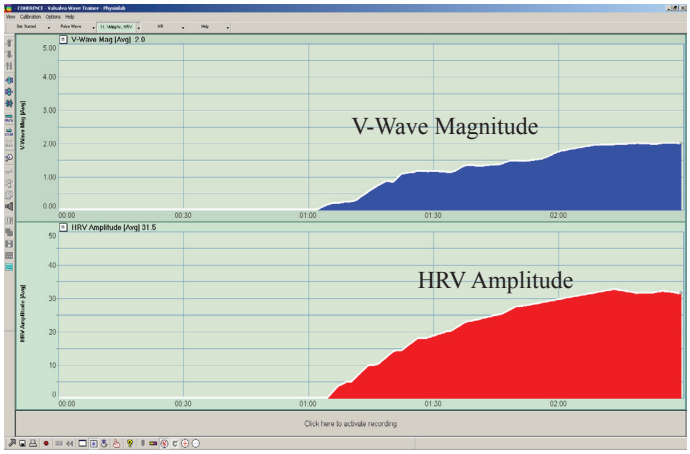


Valsalva Wave and HRV Cycle

The Valsalva Wave is an actual "blood wave" that occurs in the circulatory system as a consequence of coherent respiration. The above figure presents both the Valsalva Wave and the Heart Rate Variability Cycle as they occur in time. Note that they have a tendency to be "out of phase", heart rate rising as the Valsalva Wave falls and heart rate falling as the Valsalva Wave rises. During resonant breathing this change in blood volume corresponds with a change in blood pressure measured at the brachial artery of about 20mmHg. The present theory is that the HRV cycle is an outcome of autonomic regulation of the Valsalva Wave or the physiologic changes that cause it.

The instrument provides many different views of both Valsalva Wave and HRV, depending on the context. [The Pulse Wave is also presented along with Valsalva Wave and HRV signals for analytical purposes.] Please click here to see a formative description of available screens and metrics. The upcoming release of the instrument allows us to monitor and train the Valsalva Wave and the HRV cycle, either alone or in combination, where the fundamental training objective is "elevation" of Valsalva Wave "magnitude" and/or HRV "amplitude", both correlating primarily with the frequency, depth, and coherence of respiration, AND relaxation.

Fast Averaging



Slow Averaging

The upper left figure presents Vasalva Wave magnitude and HRV amplitude using fast averaging. This screen measures the peak-peak value of each signal and presents it with little delay. It is very responsive to changes on a cycle-cycle basis. The figure on the right presents the same metrics using much slower averaging. Here we see that individual cycles are "smoothed out" over 10s of seconds. The screen on the left is very useful for developing an understanding of how to "elevate" each of the metrics. The screen on the right is useful for a typical training session lasting 20-30 minutes. To learn more about Valsalva Wave, visit www.valsalvawave.com.

About the name "Valsalva Wave"...

In medical literature there is a term given to the understood but little recognized wave action as observed in the arterial system as a function of breathing - it is called the "Respiratory Arterial Pressure Wave". There is also a relatively obscure term for a wave phenomenon in the venous system - it is called the Venous Wave or "V-Wave". However, there is no term for the wholistic phenomenon, i.e. arterial and venous flow alternating with exhalation and inhalation respectively. Antonio Valsalva (Valsalva maneuver), an early physiologist circa 1600, is said to have observed changes in the juggler vein as a function of respiration in dogs, making him an early observer of the phenomenon. As the wave is both arterial (A) and venous (V), naming the wave the "Antonio Valsalva Wave" seems appropriate.

Thank you for your interest and consideration,

Stephen Elliott
COHERENCE