Biofeedback Device for Real-Time Sympathetic Nervous System Info
Tech ID: 32878 / UC Case 2022-987-0

BACKGROUND
People can learn to control their sympathetic nervous system in real time with biofeedback. This can help them calm themselves and become more responsive to the present moment. Two of the most powerful biofeedback measurements for this purpose are hand temperature and heart rate variability (HRV). Current biofeedback devices that measure hand temperature use contact temperature sensors that are affected by both contact pressure and environmental temperature. Current biofeedback devices for HRV use either time-domain measures or frequency-domain measures. The most important component of HRV is respiratory sinus arrhythmia, the component of HRV that is coupled to the breath. Current methods cannot fully isolate this important component from other noise sources. A device that effectively combines these measurements would be a welcome advancement to biofeedback therapy.

DESCRIPTION
Researchers at the University of California, Santa Barbara have developed a biofeedback device that helps retrain the brain to reduce sympathetic nervous system activation and improve focus, enabling chronic pain recovery, anxiety reduction, and other health improvement goals. At its heart is a novel algorithm, Dynamic Phase Extraction, based on lock-in amplifier technology, which isolates the most important component of HRV in real time. As an added advantage, Dynamic Phase Extraction gives the relative phase of the HRV and the breath. This is a new parameter that can be used, for example, as a measure of breathing depth (e.g. shallow or deep). The device uses an infrared temperature sensor to measure temperature at the extremities and a photoplethysmography (PPG) sensor to monitor pulse rate — no electrodes are necessary. The device is inexpensive and simple to operate making it suitable for at-home use as well as in a professionally-guided setting.

ADVANTAGES
▶ Does not require electrodes to be placed on body
▶ Inexpensive and suitable for at-home use
▶ Combination of temperature and pulse features yields synergistic benefits for biofeedback therapy
▶ Can use quadrant averaged technique and/or interpolation to compute heart rate variability and phase without interference due to arrhythmias, missed heartbeats, motions, or other atypical heartbeat intervals

APPLICATIONS
▶ Med Devices
▶ Biofeedback therapy devices for helping with anxiety, depression, chronic pain, and sleep
▶ Wearables

PATENT STATUS
Patent Pending

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ADDITIONAL TECHNOLOGIES BY THESE INVENTORS
▶ Precise Neural Circuit Probe with Reversible Functionality