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## **SYNCHRONIZING BRAIN AND HEART THROUGH DECELERATED RESPIRATION – AN EEG-ECG STUDY INVESTIGATING THE EFFECTS OF PACED BREATHING**

Thilo Hinterberger & Nike Walter

Research Section of Applied Consciousness Sciences,  
Department of Psychosomatic Medicine, University Clinic Regensburg, Regensburg

### **Grant 93/16**

**Background:** Numerous methods for enhancing consciousness and well-being emphasize the role of breathing. Since neural correlates of breathing were only studied within standard EEG frequencies and imaging methods, the link between body rhythms and slow cortical brain dynamics during paced breathing remained unexplored.

**Aims:** We hypothesize that with a decelerated breathing rhythm of about 10 seconds/cycle the baroreceptor activity will synchronize with the respiration which leads to an increased heart rate variability and also a synchronization with the slow cortical potentials and other brain rhythms.

**Method:** Physiological data from 37 participants are presented, who conducted paced breathing sessions with respiration rates from 6 to 14 seconds/cycle for 7 min each task. Measures of respiration, heart rate variability (HRV), and 64 channels EEG as well as subjective ratings were recorded and compared with each other.

**Results:** Both, the respiratory sinus arrhythmia of the HRV and the slow cortical potentials (SCPs) of the EEG correlated with the respiration cycle. Other EEG frequencies were only weakly influenced. The SCPs demonstrated the highest correlations at a respiration rate of 10 seconds/cycle. Here, a strong positive voltage deflection during inhalation is followed by a negative variation during exhalation (20 $\mu$ V pp). This decelerated breathing rhythm matches the frequency of the baroreceptor sensitivity, leading to synchronization between breath, HRV, baroreceptors and the brain. Subjectively, participants rated this respiration as the most relaxing one.

**Conclusions:** This study demonstrates the importance of the speed of breathing and its strong dependency with slow cortical potentials (SCPs) of the brain. In this study, we show for the first time, that decelerated breathing at a rate of 6 cycles/minute results in a great synchronicity. We were able to show that central and frontal SCPs only synchronize at slower respiration rates and already develop during the first minute of a paced breathing task. This mechanism may explain the beneficial effect ascribed to decelerated breathing in various mind-body practices. An influential effect of stress level and psychosomatic impairment on correlations of breathing rhythms in the brain could not have been validated here. Generally, more research is needed to uncover the impact of this synchrony to mental and physical health as well as on the functions of consciousness.

**Keywords:** Paced breathing, Heart rate variability (HRV), Slow cortical potentials (SCP), Synchronicity

**Publications:***Peer reviewed journal article*

Hinterberger, T., Walter, N., Doliwa, C., Loew, T., (2019). The brain's resonance of breathing – decelerated breathing synchronizes heart rate and slow cortical potentials. *Journal of Breath Research*, 13, 046003. <https://doi.org/10.1088/1752-7163/ab20b2>

*Conference presentations*

Hinterberger, T.: "Breathing and the brain – decelerated breathing synchronizes brain and body rhythms". DGPPN Conference (German Association for Psychiatry, Psychotherapy and Psychosomatics) "Focusing on the Future", 28 November – 1 December 2018, Berlin, Germany

Hinterberger, T.: "Breathing and the brain – decelerated breathing synchronizes brain and body rhythms" Abstract and oral presentation at TSC Conference "Towards a Science of Consciousness", 26-28 June 2019, Interlaken, Switzerland

**E-mail contact:** [Thilo.Hinterberger@ukr.de](mailto:Thilo.Hinterberger@ukr.de)