

https://dspace.org/

The effect of spontaneous versus paced breathing on EEG, HRV, skin conductance and skin temperature

Klette, Brett Alan

2017

http://hdl.handle.net/10539/22994

Klette, Brett Alan (2017) The effect of spontaneous versus paced breathing on EEG, HRV, skin conductance and skin temperature, University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/22994>

Downloaded from a DSpace repository. https://dspace.org/

RESEARCH ABSTRACT

It is well known that emotional stress has a negative impact on people's health and physical, emotional and mental performance. Previous research has investigated the effects of stress on various aspects of physiology such as respiration, heart rate, heart rate variability (HRV), skin conductance, skin temperature and electrical activity in the brain. Essentially, HRV, Electroencephalography (EEG), skin conductance and skin temperature appear to reflect a stress response or state of arousal. Whilst the relationship between respiration rate, respiration rhythm and HRV is well documented, less is known about the relationship between respiration rate, EEG, skin conductance and skin temperature, whilst HRV is maximum (when there is resonance between HRV and respiration i.e. in phase with one another).

This research project aims to investigate the impact that one session of slow paced breathing has on EEG, heart rate variability (HRV), skin conductance and skin temperature. Twenty male participants were randomly assigned to either a control or intervention group. Physiological data were recorded for the intervention and control group during one breathing session, over a short initial baseline (B1), a main session of 12 minutes, and a final baseline (B2). The only difference between the control and intervention groups was that during the main session, the intervention group practiced slow paced breathing (at 6 breaths per minute), while the control group breathed spontaneously. Wavelet transformation was used to analyse EEG data while Fourier transformation was used to analyse HRV.

The study shows that slow-paced breathing significantly increases the low frequency and total power of the HRV but does not change the high frequency power of HRV. Furthermore, skin temperature significantly increased for the control group from B1 to Main, and was significantly higher for the control group when compared to the intervention group during the main session. There were no significant skin temperature changes between sessions for the intervention group. Skin conductance increased significantly from Main to B2 for the control group. No significant changes were found between sessions for the intervention group and between groups. EEG theta power at Cz decreased significantly from Main to B2 for the control group only, while theta power decreased at F4 from Main to B2 for both groups. Lastly, beta power at Cz decreased from B1 to B2 for the control group only.

This significant effect that slow-paced breathing has on HRV suggests the hypothesis that with frequent practice, basal HRV would increase, and with it, potential benefits such as a reduction in anxiety and improved performance in specific tasks. Slow-paced breathing biofeedback thus shows promise as a simple, cheap, measurable and effective method to reduce the impact of stress on some physiological signals, suggesting a direction for future research.