

Effects of Spectrotemporal Modulation of Music Profiles on Coherence of Cardiovascular Rhythms

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Abstract : The powerful effect of music is often associated with changes in physiological responses such as heart rate and respiration. Previous studies demonstrate that Mayer waves of blood pressure, the spontaneous rhythm occurring at 0.1 Hz, corresponds to a progressive crescendo of the musical phrase. However, music contain dynamic changes in temporal and spectral features. As such, it remains unclear which aspects of musical structures optimally affect synchronization of cardiovascular rhythms. This study investigates the independent contribution of spectral pattern, temporal pattern, and dissonance level on synchronization of cardiovascular rhythms. The regularity of acoustical patterns occurring at a periodic rhythm of 0.1 Hz is hypothesized to elicit the strongest coherence of cardiovascular rhythms. Music excerpts taken from twelve pieces of Western classical repertoire were modulated to contain varying degrees of pattern regularity of the acoustic envelope structure. Three levels of dissonance were manipulated by varying the harmonic structure of the accompanying chords. Electrocardiogram and photoplethysmography signals were recorded for 5 minutes of baseline and simultaneously while participants listen to music excerpts randomly presented over headphones in a sitting position. Participants were asked to indicate the pleasantness of each music excerpt by adjusting via a slider presented on screen. Analysis of the Fourier spectral power of blood pressure around 0.1 Hz showed a significant difference between music excerpts characterized by spectral and temporal pattern regularity compared to the same content in random pattern. Phase coherence between heart rate and blood pressure increased significantly during listening to spectrally-regular phrases compared to its matched control phrases. The degree of dissonance of the accompanying chord sequence correlated with level of coherence between heart rate and blood pressure. Results suggest that low-level auditory features of music can entrain coherence of autonomic physiological variables. These findings have potential implications for using music as a clinical and therapeutic intervention for regulating cardiovascular functions.

Keywords : cardiovascular rhythms, coherence, dissonance, pattern regularity

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