The Paradox of Emotional Dimensionality: The Effect of the Dimensionality of Audio Stimuli on the Brain’s Electrical Activity, a Neuroscience Study

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There is tangible proof that music therapy works in treating symptoms of mood disorders (clinical depression and bipolar disorders), neurological disorders (schizophrenia, amnesia, Alzheimer's, etc.), and anxiety disorders (Post-Traumatic Stress Disorder and Attention Deficit Disorder). The mechanisms of action and the origins of these phenomena present a confusing picture to experts in the field. The purpose of this research study was to find a mathematical correlation between the Fractal Dimension (Dimensionality) of audio stimuli and the selective emotions induced by the stimuli and to monitor if these results would be confirmed and verified using Electroencephalography (EEG). This study reveals that the internal mathematical structure of the sound-stimuli itself could be responsible for the induction of selective emotions. There is a trend between low Fractal Dimension audio stimuli and the “positive” emotional responses of joy (serenity, ecstasy, etc.) along with a shortening effect on time perception. Meanwhile, high Fractal Dimension audio stimuli were shown to predominantly trigger “negative” emotional responses of fear (apprehension, terror, etc.) with a lengthening effect on time perception. These results support the idea that primary emotions could be universal across cultures and may have an evolutionary and biological basis. This is the first time that the dimensionality of sounds and music are correlated with the selective triggering of emotions. This study provides a fundamental understanding to advance the fields of biomathematics, emotional research, and music therapy.

Awards Won:

Intel Foundation Cultural and Scientific Visit to China Award