

Music as a model for acoustic communication of emotions in humans

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Although music is generally acknowledged as a powerful tool for eliciting emotions, little is known concerning the neurobiological basis of these emotions. In a preliminary study, the neurobiological basis of emotional valence judgements while listening to complex auditory stimuli was investigated. Cortical DC-EEG-activation patterns were recorded from 16 right-handed students. Students listened to 160 short sequences taken from the repertoires of jazz, rock-pop, classical music and environmental sounds (each n=40). Emotional valences of the perceived stimuli were rated on a five-step scale after each sequence. Brain activation patterns while listening revealed widespread bilateral fronto-temporal activation, but showed a highly significant lateralisation effect: positive emotional attributions were accompanied by an increase in left-temporal activation, negative attributions by a more bilateral pattern with preponderance of the right fronto-temporal cortex. The results are in keeping with Davidson's "Hemisphere hypothesis", saying the valence judgements are processed in different hemispheres depending on whether positive or negative emotions are reported.

In a second experiment, we investigated the psychological and neurobiological basis of strong emotional responses to music (SEM), leading to shivers down the spine and changes in heart rate. From previous studies it is known that these SEMs are accompanied by the activation of a brain network that includes the ventral striatum, midbrain, amygdala, orbitofrontal cortex and ventral medial prefrontal cortex — areas that are thought to be involved in reward, emotion and motivation (Panksepp and Bernatzky 2002). Personality factors may influence intensity, frequency and nature of these physical responses. 40 subjects (22 female, 18 male) listened to 6 standard excerpts of classical music. Their physical reactions to the music were assessed by means of questionnaires. In addition, personality traits were recorded with the Affective Neuroscience Personality Scales (ANPS) and the Tellegen Absorption Scale (TAS). Overall, strong emotional responses were reported by 90% of the subjects. Emotional reactions were more frequent when pieces were familiar. Subjects scoring highly on the TAS, and thus revealing a greater ability to completely dedicate themselves to an object or a situation, were more likely to report physical reactions than others. Furthermore, higher scores on the SEEK scale of the ANPS (reflecting sensation seeking tendencies) paired with low FEAR scores was related to increased emotional reactivity.

These results demonstrate that strong emotional responses are not only related to the psychoacoustic properties of the respective pieces of music, but furthermore to biographical memories and personality traits.

Lit: Davidson RJ et al. *Brain Cogn.* 1987 ; 6: 403-11.

Panksepp J, Bernatzky G. *Behav Processes.* 2002; 60:133-155.