The role of the basal ganglia in rhythmic entrainment and musical emotions

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Abstract

This study investigated the neural mechanisms of rhythmic entrainment by musical meter and its modulation by aesthetic appreciation with the use of functional MRI. Rhythmic entrainment has been considered to contribute to emotion induction in response to music (Juslin et al., 2010). Moreover, the basal ganglia have been reported both to be sensitive to musical rhythms and to be recruited during the processing of musical emotions. Therefore we tested whether pleasant music would lead to stronger entrainment effects and asked whether such effects might involve the basal ganglia.

We designed an fMRI study where participants (n = 18) listened to piano music while performing a visual speeded response task. The task consisted of detecting visual cues that appeared time locked to either a strong or a weak beat of the musical meter. Each musical piece was presented in both a consonant and a dissonant version.

Behavioral results showed a main effect of meter and a main effect of consonance on reaction times but no interaction. fMRI results show a main effect of meter in bilateral caudate nucleus, whereas a main effect of consonance was found in an attentional network including parietal regions as well as motor areas. An interaction between meter and consonance was found in the caudate body. These results show that the basal ganglia (caudate nucleus) are sensitive to subtle differences of rhythmic expectancies. Furthermore, the results suggest that entrainment of perceptual and attentional processes to the musical beat may represent a relatively automatic process, independent of aesthetic appreciation.

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