

# **Auditory-motor Facilitation by the Auditory Context of Music or Rhythm**

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**Keywords:** music; rhythm; motor control; auditory; facilitation; event-related potentials (ERPs).

People dance to music. But why is this so? This work investigated auditory-motor facilitation in normal subjects, using two auditory contexts, music and simple rhythm. Auditory-motor facilitation is frequently adopted in treating bradykinesia in patients with Parkinson's disease. Bradykinesia, impaired coordination and gait performance in patients with Parkinson's disease can be immediately managed by auditory rhythm cues. Hence, a circuit linking the auditory and motor preparatory systems is postulated in the diseased brain. However, the evidence for the normal brain is still lacking. It is hypothesized that music contributes to the modulation of motor planning and motor preparation so that the readiness potential (RP) and negative slope (NS) of movement-related cortical potential (MRCP) preceding the movement would be evidently enhanced in auditory context of music.

Ten normal adult subjects were enrolled. Three conditions were performed, each lasted for 18 minutes with several rest breaks. The three conditions were the music condition, rhythm and silent conditions. In the music condition, the composition 12 Variations on the Theme of 'Ah, Vous dirai-je, Maman' in C major, KV.265 (Mozart) was played. In the rhythm condition, a regular metronome beep was played with the tempo identical to that in the music condition. The silent condition had no music or beep. In each condition, subjects performed repetitive brisk simultaneous extensions of their finger II-V followed by brief relaxation to reposition their fingers on the preparatory position at 5-10 second intervals. Neuroscan instrument and software (Neuroscan

Inc.), including a 34 lead head Ag-AgCl cap and a DC amplifier were used to record the EEG in the scalp leads. Artifact rejection and EMG-locked averaging was performed offline.

The NS and RP of MRCP were most prominent in electrodes overlying the supplementary motor area (SMA), premotor cortex and primary motor cortex; namely, F3, F4, FZ, FC3, FC4, FCZ, C3, C4, and CZ. These electrodes will be analyzed for MRCP.

The music condition began to demonstrate enhanced negative deviation from the silent or rhythm conditions from 1000 ms before movement, involving in period of the RP. The rhythm condition began to differ from the silent condition from 500 ms before movement, at around the onset of the NS. Generally, the music condition demonstrated the greatest enhancement of the negative deviation of MRCP in the RP and NS. The rhythm condition also exhibited significant enhancement, but to a lesser degree than the music condition.

This investigation provides electrophysiological evidence for auditory-motor facilitation, which is marked when listening to music or simple rhythm. The facilitation starts in the motor planning and preparatory phases. Electrophysiologically, the auditory-motor facilitation induced by music is greater than that induced by simple rhythm. For this, music is theoretically richer in the auditory content as it contains both rhythm and melody. The combination of rhythm and melody attributes to more intensive modulation of cognitive processes, thus effectively facilitating the motor planning and preparation.