The Role of Cerebral Resonance Behavior in the Control of Music Performance

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Hypothesis

While *listening* to music, non score-dependent musicians will exhibit the recruitment of pre-motor and parietal cortical fields normally active while playing. Score-dependent musicians will exhibit this recruitment to a lesser degree.

The organization of goal-directed movement is particularly embedded in parietal-pre-motor circuitry (de Jong et al. 2001). Sensory stimuli facilitate this system to express 'resonance behavior', the virtual replication of observed behavior in the brain. It is plausible that listeners map what they hear onto their own motor representation of the music, which would explain why people either hum along with the melody of a popular song or tap the beat . The ability of non score-dependent instrumentalists to play by ear in various tonalities could be the manifestation of enhanced motor resonance behavior.
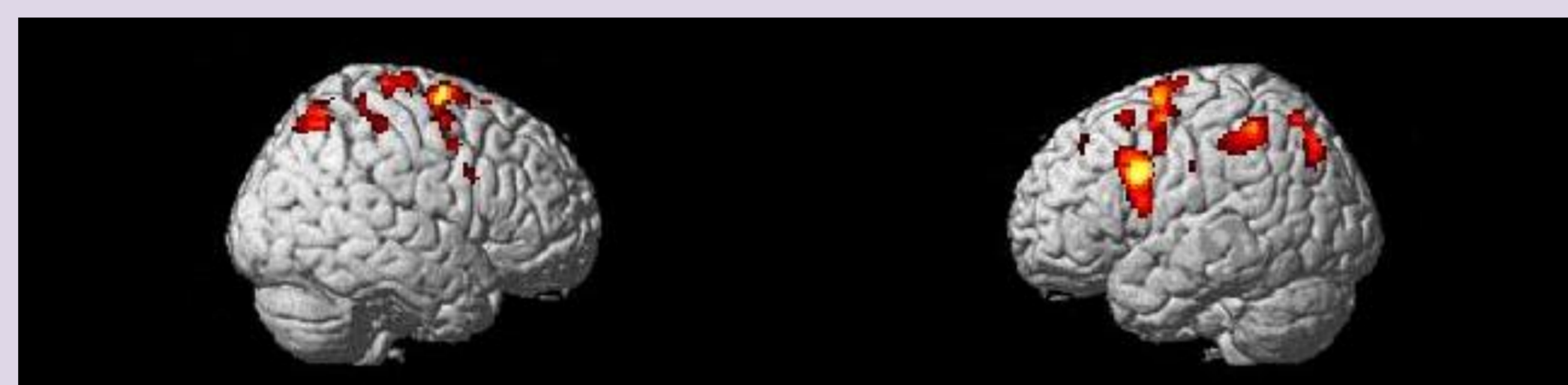
Results

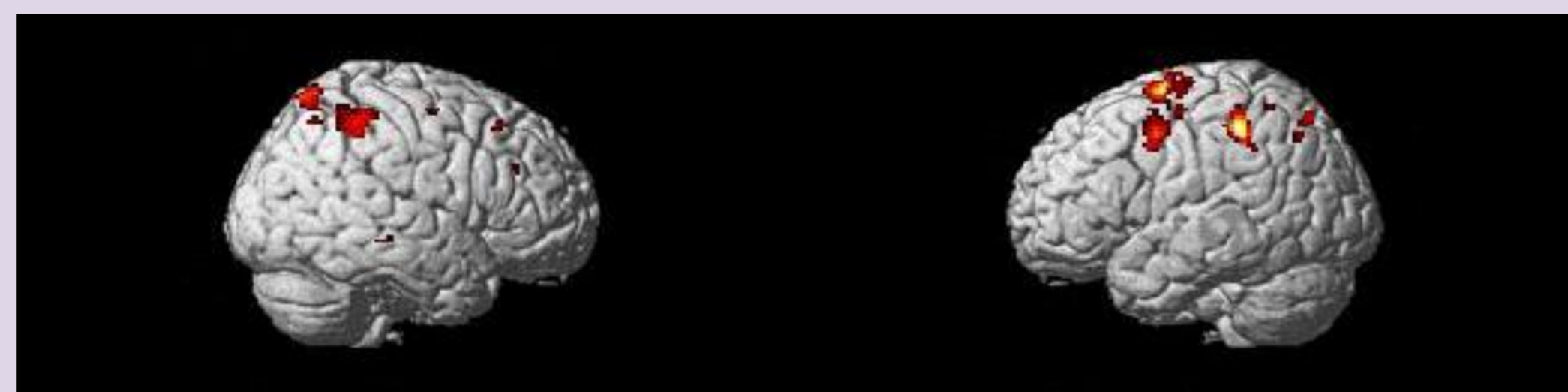Non score-dependent organists/pianists (n=9)

Score-dependent organists/pianists (n=7)
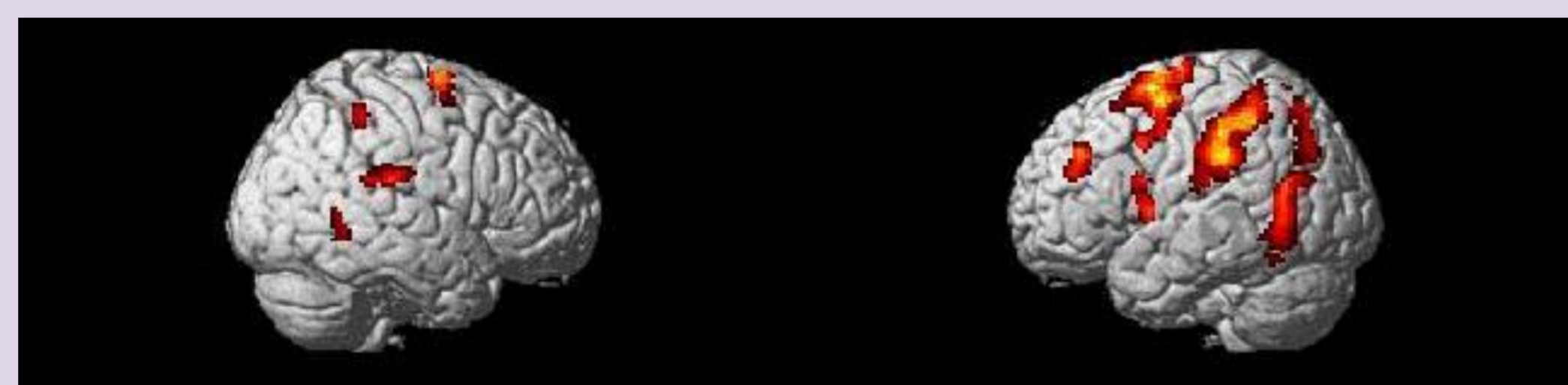
Musically unskilled controls (n=9)

Motor imagery vs. explicit judgement

$p < 0.001$ (uncorr.) / ext. 8
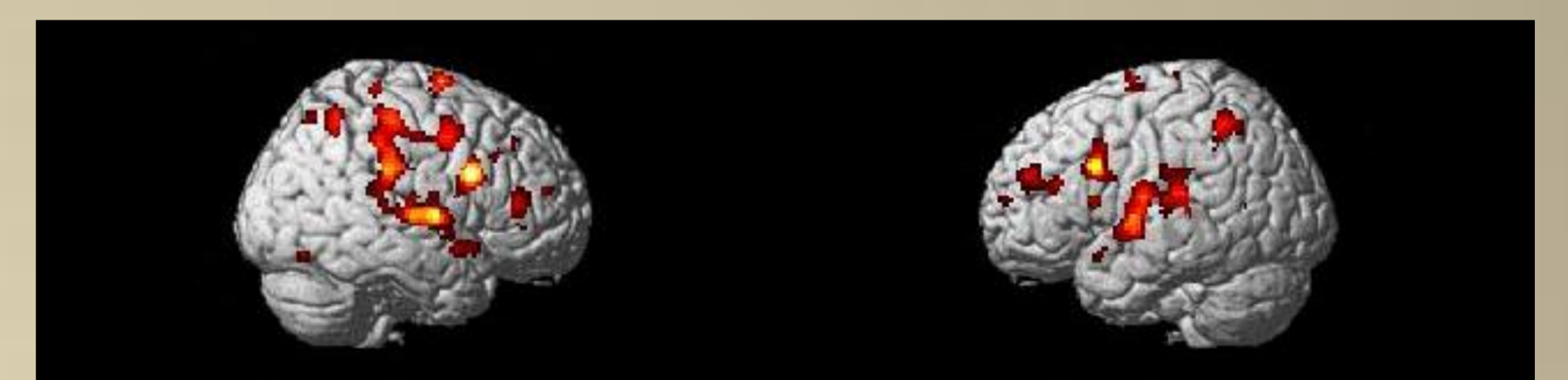

$p < 0.001$ (uncorr.) / ext. 8

$p < 0.001$ (uncorr.) / ext. 8

Motor imagery: non score-dependent vs. musically unskilled

$p < 0.001$ (uncorr.) / ext. 8

Motor imagery: non score-dependent vs. score-dependent

$p < 0.001$ (uncorr.) / ext. 8

Methods

Stimuli
48 pieces written in two-part harmony, half of which are taken from the repertoire, half composed specifically for the experiment.

Experimental conditions
1. motor imagery vs. explicit judgment

2. familiar music vs. unfamiliar music

Data acquisition & analysis
3T fMRI measures task-induced Blood Oxygen Level Dependent (BOLD) responses. The analysis is performed with Statistical Parametric Mapping.

CONCLUSIONS

Imagery performance in non score-dependent musicians appears to be characterized by:
➢ enhanced activity in the premotor-parietal network
➢ moderate right-lateralization of parietal activity
➢ enhanced activity in the primary auditory cortex