Multisensory brain sites for kinesthesia: an fMRI study

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Abstract

To perceive one's own body movements, the CNS uses multiple sensory information derived from several modalities including vision, touch, and muscle proprioception. All these sources of information have to be efficiently merged together to form a coherent percept. In this study we used functional magnetic resonance imaging (fMRI) to investigate where multisensory integration processing takes place in the human brain.

For this purpose, illusory sensations of clockwise rotations of the right hand were induced by stimulating three sensory channels either separately or simultaneously: *Muscle Proprioception* was activated using a pneumatic vibrator applied to the *pollicis longus* muscle; *Touch* was activated by an amagnetic disk scrolling under the subject's hand, and *Vision* was stimulated using a movie of a background rotating under the subject's hand. Outside the scanner, kinesthetic illusions were copied by the subjects and the associated motor responses in wrist muscles were recorded.

Psychophysical and electromyographic data recorded on 14 subjects show that the three unimodal stimulation induced similar perceptual and motor responses and that bi- and trimodal stimulation improved velocity and latency of kinesthetic perceptions. Preliminary fMRI results on 3 subjects suggest that the sensorimotor network classically associated with a kinesthetic illusion is activated regardless of the sensory modality through which such illusion was evoked. A group analysis performed on the 14 subjects should permit to further elucidate whether heteromodal brain regions are specifically dedicated to multisensory integration and/or whether a mere co-activation of the unimodal brain networks can account for multisensory interactions.

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