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How does the body representation system develop in the human brain?

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Abstract

Exploration of the body representation system (BRS) from kinaesthetic illusions in fMRI has revealed a complex network composed of sensorimotor and frontoparietal components. Here, we evaluated the degree of maturity of this network in children aged 7-11 years, and the extent to which structural factors account for network differences with adults. Brain activation following tendon vibration at 100 Hz ('illusion') and 30 Hz ('no illusion') were analysed using the two-stage random effects model, with or without white and grey matter covariates. The BRS was already well established in children as revealed by the contrast 'illusion' vs. 'no illusion', although still immature in some aspects. This included a lower level of activation in primary somatosensory and posterior parietal regions, and the exclusive activation of the frontopolar cortex (FPC) in children compared to adults. The former differences were related to structure, while the latter difference reflected a functional strategy where the FPC may serve as the 'top' in top-down modulation of the activity of the other BRS regions to facilitate the establishment of body representations. Hence, the development of the BRS not only relies on structural maturation, but also involves the disengagement of an executive region not classically involved in body processing.

Keywords

Body representation system; Proprioception; fMRI; DTI; VBM; Children

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