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Intentionally not imitating: Insula cortex engaged for top-down control of action mirroring

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ABSTRACT

Perception and action are inextricably linked, down to the level of single cells which have both visual and motor response properties – dubbed ‘mirror neurons’. The mirror neuron system is generally associated with direct-matching or resonance between observed and executed actions (and goals). Yet in everyday interactions responding to another’s movements with matching actions (or goals) is not always appropriate. Here we examine processes associated with intentionally not imitating, as separable from merely detecting an observed action as mismatching one’s own. Using fMRI, we test how matched and mismatched stimulus-response mapping for actions is modulated depending on task-relevance. Participants were either cued to intentionally copy or oppose a presented action (intentional imitation or counter-imitation), or cued to perform a predefined action regardless of the presented action (incidental imitation or counter-imitation). We found distinct cortical networks underlying imitation compared to counter-imitation, involving areas typically associated with an action observation network and widespread occipital activation. Intentionally counter-imitating particularly involved frontal-parietal networks, including the insula and cingulate cortices. This task-dependent recruitment of frontal networks for the intentional selection of opposing responses supports previous evidence for the preparatory suppression of imitative responses. Sensorimotor mirroring is modulated via control processes, which complex human interactions often require.

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