

530.07 / WW20 - From agents to actions to interactions: Uncovering multiple social networks in the primate brain

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Abstract

Our brain continuously decodes the complex visual scenes unwinding in front of us: both the nature of material entities we perceive, such as objects and individuals, and their immaterial interactions. Interactions are recognized quickly and effortlessly by primates: They understand fights, grooming and plays, but also colliding objects that exchange forces following physical laws of classical mechanics. Interactions are fundamental in that they reveal hidden properties of objects, e.g. their weight or material, and of individuals, e.g. their dominance status or relationship, and by doing so they determine and teach the observer about its own position and prospects regarding those entities. However little is known about the brain regions that track and process social and physical interactions. In order to chart these regions, videos of three types of interactions 1) social interactions between monkeys, 2) interactions between monkeys and objects or their environment and 3) physical interactions between objects, were projected to four rhesus monkeys being scanned for fMRI acquisition with contrast agent. Whole-brain activity for watching blocks of interactions was compared to the activity for watching control videos of monkeys making no actions, objects moving with no interactions, landscapes and scrambled motion videos using Fixed Effects (FFX) Generalized Linear Model (GLM) group analysis and conjunction analyses. We show that watching interactions over-activates the STS, but engages also two sets of regions located outside: 1) it activates the fronto-parietal mirror neuron system (mapped independently using a classic localizer) more than watching non-interactive goal directed behaviors that define the system; 2) in the case of social interactions, it additionally exclusively activates the medial-prefrontal cortex (mPFC), a putative temporo-parietal junction homolog and the temporal pole (TP) that appear to correspond to the human mentalizing network. These two networks are fed differentially by patches of STS cortex (mapped independently using a classic Face-Object-Body patch localizer): face patches co-activate with the social brain, while body patches co-activate with both the mirror neuron system and the social brain. These results demonstrate that combining individuals or objects into evocative units modulates basic mechanisms of object and individual perception in the STS, they reveal the mirror neuron system's nature of node of convergence between the social and non-social brain, and suggest that human unique and sophisticated mind-reading ability evolved from the faculty shared with our monkey kin to read social interactions.