

## **Affective and cooperative interactions modulate brain connectivity within the action observation network**

### **Connectivity in the action observation network**

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### *Abstract*

Decoding the meaning of others' actions, a crucial step for social cognition, involves different neural mechanisms. While the "mirror" and "mentalizing" systems have been associated with, respectively, the processing of biological actions vs. more abstract information, their respective contribution to intention understanding is debated. Processing social interactions recruits both neural systems, with a different weight depending on cues emphasizing either shared action intentions or shared mental states. We have previously shown that observing cooperative and affective social interactions elicits stronger activity in the key-nodes of the mirror (left posterior superior temporal sulcus (pSTS), posterior parietal (PPC) and premotor cortex (PMC)) and mentalizing (ventromedial prefrontal cortex (vmPFC)) systems, respectively. Here we aim at unveiling their neural dynamics by means of dynamic causal modeling in 36 healthy human subjects. We investigated the causal organization underlying the observation of human interactions expressing increasing cooperativity (involving left pSTS, PPC and PMC) vs. affectivity (vmPFC). We found very strong evidence for a neural model including the pSTS as a gateway for both the observed interactions and the degree of their affectivity. The extrinsic connectivity of this input node is subject to oppositely valenced modulations by cooperativity and affectivity, promoting, respectively, reciprocal excitatory connectivity with PPC (mainly forward) and vmPFC (mainly backward). Consistently with fMRI data, such divergent effective connectivity suggests that different dimensions underlying the processing of social interactions recruits distinct, although strongly interconnected, neural pathways associated with the bottom-up visuomotor processing of motor intentions and the top-down attribution of affective and mental states.