Proverbio AM, Riva F, Paganelli L, Cappa SF, Canessa N, Perani D, Zani A. Neural coding of cooperative vs. affective human interactions: 150 ms to code the action's purpose PLoS One. 2011;6(7)

Abstract

The timing and neural processing of the understanding of social interactions was investigated by presenting scenes in which 2 people performed cooperative or affective actions. While the role of the human mirror neuron system (MNS) in understanding actions and intentions is widely accepted, little is known about the time course within which these aspects of visual information are automatically extracted. Event-Related Potentials were recorded in 35 university students perceiving 260 pictures of cooperative (e.g., 2 people dragging a box) or affective (e.g., 2 people smiling and holding hands) interactions. The action's goal was automatically discriminated at about 150-170 ms, as reflected by occipito/temporal N170 response. The swLORETA inverse solution revealed the strongest sources in the right posterior cingulate cortex (CC) for affective actions and in the right pSTS for cooperative actions. It was found a right hemispheric asymmetry that involved the fusiform gyrus (BA37), the posterior CC, and the medial frontal gyrus (BA10/11) for the processing of affective interactions, particularly in the 155-175 ms time window. In a later time window (200-250 ms) the processing of cooperative interactions activated the left post-central gyrus (BA3), the left parahippocampal gyrus, the left superior frontal gyrus (BA10), as well as the right premotor cortex (BA6). Women showed a greater response discriminative of the action's goal compared to men at P300 and anterior negativity level (220-500 ms). These findings might be related to a greater responsiveness of the female vs. male MNS. In addition, the discriminative effect was bilateral in women and was smaller and left-sided in men. Evidence was provided that perceptually similar social interactions are discriminated on the basis of the agents' intentions quite early in neural processing, differentially activating regions devoted to face/body/action coding, the limbic system and the MNS.