

Neural responses to emotionally-salient social information: an event-related functional MRI study

Daphne J. Holt¹, W. Caroline West², Balaji Lakshmanan², Scott L. Rauch¹,
Gina R. Kuperberg^{1,2,3}

¹*Dept. of Psychiatry, Mass/ General Hospital, Charlestown MA*

²*Martinos Center for Biomedical Imaging, Mass. General Hospital, Charlestown, MA*

³*Department of Psychology, Tufts University, Medford, MA*

Background: Neuroimaging studies using affectively-valenced words and faces have demonstrated that emotional perception involves a network of brain regions including medial temporal lobe structures, the striatum and medial prefrontal and posterior cingulate cortices. Here we tested whether the same regions involved in the emotional appraisal of these relatively simple stimuli also participate in the evaluation of sentences describing complex social information.

Methods: We constructed and validated a stimuli set consisting of 405 sentence pairs describing social situations with negatively-valenced, positively-valenced and affectively neutral (and ambiguous) content. The valence of the sentence pair/social situation was conferred by a pleasant, unpleasant or neutral word (the critical word) in the second sentence. (Example: Sandra's old boyfriend stopped by her apartment. This time he brought a rose/gun/letter (*pleasant/unpleasant/neutral conditions*) with him.) Fifteen healthy individuals underwent fMRI scanning (3T, Siemens Trio) while judging whether sentence pairs, presented in pseudorandom order, depicted pleasant, unpleasant or neutral social situations. The second sentence of each sentence pair was presented one word at a time (stimulus duration for each word: 500 ms; interstimulus interval: 100 ms).

Functional MRI data were analyzed using the FreeSurfer Functional Analysis Stream: BOLD signal averages and variances from correctly answered trials only (all subjects made >70% correct responses) were computed using a finite impulse-response model and resampled into Talairach and spherical space. Inter-subject averaging was performed using a random effects analysis.

Results: Subjects responded more quickly to unpleasant and pleasant scenarios than to neutral scenarios ($p < .05$). At 5-7 seconds following the critical word, the unpleasant scenarios (relative to the neutral scenarios) were associated with a greater hemodynamic response ($p < .001$) in the left hemisphere in the cingulate gyrus (anterior and posterior) and medial prefrontal cortex (PFC), and, in the right hemisphere in the caudate nucleus, insula, medial temporal lobe (amygdala, hippocampus and parahippocampal gyrus) and fusiform gyrus. Responses to the pleasant scenarios exhibited a similar (but less robust) pattern. At 7-11 seconds following the critical word, the neutral scenarios (relative to the unpleasant or pleasant scenarios) were associated with a greater hemodynamic response within the right lateral PFC (inferior and middle frontal gyri and orbitofrontal cortex).

Conclusions: The modulation of limbic cortical and subcortical areas during the explicit evaluation of unpleasant and pleasant social situations supports the hypothesis that these regions mediate the processing of emotionally-salient social information. The later, more prolonged activity of the right lateral PFC during the evaluation of neutral social situations could reflect a relatively greater cognitive effort in evaluating these more ambiguous, neutral scenarios.