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Affective appraisal of avatar postures: An fMRI study

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Objective: Although body postures are a powerful means of expressing emotional states, most fMRI studies of affective appraisal of non-verbal communication have focused on emotional facial expressions. Only recently (1) have the neural correlates of perception of body expression of fear been investigated. That study showed clear activations of fusiform gyrus (previously associated with the processing of face and facial expressions) and amygdala. The present fMRI study was designed to investigate the neural correlates of affective appraisal of postural expressions of various emotional states.
Methods: Stimuli consisted of 5x6 human postures depicted by an anthropomorphic avatar without facial features. The postures were obtained from motion capture of actors expressing five different emotional states (happy, sad, angry, fearful, neutral). Stimuli selection followed the results of a separate behavioral study (2). The subjects of this study were instructed to rate the emotional expressiveness of each stimulus on a three finger rating scale (from neutral to very expressive). Each stimulus was presented for 400ms with ISIs of 6.125s and a p=.2 probability of null-events during which a fixation cross was displayed. Sixteen Japanese right-handed university students (9 males, aged 20-27) participated after providing informed consent according to AIST safety and ethics guidelines. Scanning was performed on a GE 3T Signa scanner (23 slices covering the whole brain, 3.125x3.125x5 mm voxel, T2* weighted gradient echo EPI, TR=2s, TE=29.8ms). After standard preprocessing (SPM2), statistical analysis was carried out using ANOVAs (within subjects) over specific contrasts from the first level analysis (GLM) of each subject with rating as a covariate.
Results & Discussion: A linear increase of hemodynamic activation correlated to rising expressiveness of the stimulus was observed in the anterior cingulate gyrus (Table 1, pFWE_corrected<.05). Other activations (task-specific contrast) yielded the activations shown in Table 2 (pFWE_corrected<.05). The cluster of activation observed in the inferior temporal gyrus overlaps a region recently shown to relate to the processing of body-related parts (3). The absence of amygdala activation may be explained by the fact that emotions other than fear were considered, and also by the cognitive, rather than emotional, nature of the task. This is confirmed by an ACC activity restricted to its dorsal (cognitive) division (4). The clusters in BA7 and BA46 are reasonable given the strong reciprocal connections between those areas and the ACC, with BA46 possibly regulating (5) the activity of BA47, a putative locus of the human mirror neuron system.
Conclusions: The study extends the recent observation (1) that face-sensitive regions contribute to the processing of expressiveness of postures even when no facial cues are available. Activation in the mirror neuron system suggests that affective appraisal of expressiveness of body postures may proceed from motor simulation based theory of mind modulated by the cognitive division of the anterior cingulate gyrus.

References & Acknowledgements:

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Voxels	P_{FWE}	P_{FDE}	T	Location			Region	BA	Range
15	0.013	0.017	9.14	-7	11	34	Cingulate Gyrus	32	1

Voxels	P_{FWE}	P_{FDR}	T	Location			Region	BA	Range
2410	0.000	0.000	18.48	-31	0	47	Middle Frontal Gyrus	6	3
90	0.000	0.000	15.72	-51	34	22	Middle Frontal Gyrus	46	3
188	0.000	0.000	15.43	49	33	13	Middle Frontal Gyrus	46	3
661	0.000	0.000	17.83	51	13	32	Middle Frontal Gyrus	9	1
163	0.007	0.000	9.95	-31	24	-6	Inferior Frontal Gyrus	47	7
73	0.008	0.000	9.77	-31	-57	48	Superior Parietal Lobule	7	3
40	0.021	0.000	8.78	33	-61	43	Superior Parietal Lobule	7	1
94	0.015	0.000	9.15	27	-74	31	Precuneus	19	7
24	0.025	0.000	8.56	-9	-71	40	Precuneus	7	1
535	0.000	0.000	14.39	45	-45	-21	Fusiform Gyrus	37	7
9	0.032	0.000	8.34	-43	-47	-21	Fusiform Gyrus	37	7
130	0.009	0.000	9.71	47	-60	-3	Inferior Temporal Gyrus	19	5
134	0.014	0.000	9.17	39	-75	3	Middle Occipital Gyrus	19	7
56	0.016	0.000	9.03	-29	-81	4	Middle Occipital Gyrus	18	5

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