Poster presentation

Differential hemispheric activation in emotional responses: evidence by conjugate lateral eye movements

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Background

Feeling an emotion involves several structures and levels of organization in the brain. Although emphasis has been given on "bottom-up" systems originating in brainstem and limbic structures, "top-down" systems originating in the cerebral cortex are highly intertwined with human emotionality in regulating these phylogenetically old systems and modulating emotional expression. Moreover, clinical, EEG and neuroimaging evidence suggetsts a differential involvement of the two cerebral hemispheres in the processing of different emotional stimuli. The present study investigates the potentially differential processing of 4 basic emotions (joy, anger, fear, sadness) by the two hemispheres, as evidenced by the spontaneous conjugate lateral eye movements produced by the hemispheric activation (frontal eye fields).

Materials and methods

Sixty randomly chosen healthy adult students participated in an within-subjects design with four emotional levels (joy, fear, sadness, anger) and two horizontal gaze levels (left, right). Subjects answered to an ad hoc questionnaire of 20 questions designed to target particular emotions (4 × 5), in a face-to-face condition with the inreviewer and were simultaneously videotaped, and they stated the emotion felt with each question. Only horizontal spontaneous eye movements were recorded for each emotional question.

Results

Inter-rater reliability of L-R assessments (interviewer vs videotape) was estimated by Pearson's product moment correlation (p = 0.001). Construct validity of the questionnaire (targeted vs induced emotion) was estimated by Pearson's product moment correlation (p = 0.001). The means of L and R gaze for the 4 emotions were: joy R: 2.48 + 1.22 L: 1.47 + 0.91; fear R: 1.68 + 0.95 L: 2.05 + 0.64; sadness R: 1.83 + 0.80 L: 1.78 + 0.97; anger: R: 2.47 + 1.11 L: 1.47 + 0.87. The ANOVA results for the interaction of the effects of emotion and conjugate lateral eye movements were found to be highly significant (F = 11.1, df = 2.84, Eta2 = 1.59, p = 0.001). After Bonferroni correction, pair-sampled t-tests were performed for joy (p = 0.001), anger (p = 0.001), fear (p = 0.055), and sadness (p = 0.076).

Discussion

a) The ad hoc questionnaire used showed a high inter-rater reliability and construct validity.

b) The indirectly (cognitively) induced emotions interacted significantly with conjugate lateral eye movements.

c) Left hemisphere activation was shown to be significant for the emotions of joy and anger. Hemispheric lateralization was not significant for fear and sadness.

d) Results may be better explained by an "approach vs avoidance/separation" behavior dichotomy, rather by a descriptive "positive vs negative" emotions dichotomy.