

Sad but beautiful; Brain responses to emotional appraisal and aesthetic judgment of art

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Introduction: People often find artworks inducing negative emotion beautiful. The deep sorrow evoked by listening to Vitali's Chaconne in G minor or the tragic feelings expressed in Picasso's "Poor People on the Seashore" is associated with experiencing beauty. In brain imaging studies on art, however, aesthetic experience has been confounded by positive emotional contents in artworks (Koelsch S., 2006) or positive emotional appraisal (Cinzia, D. D., 2009). Using fMRI, we investigated 1) whether brain areas involved in aesthetic judgment can be distinguished from those involved in emotional appraisal and 2) whether artworks that are judged to be beautiful while inducing negative emotion recruit brain areas dissimilar to those associated with beautiful-positive artworks.

Methods: Participants. 15 healthy volunteers (11 females, age: 20-29, all right-handed) participated in the fMRI study. Participants, who were not specialized in art, were screened based on their interest in art (Belke, B., 2006). Stimuli. Among 100 pieces of 19th century impressionists' paintings, 64 pieces were chosen by a pilot study. They were classified into 4 categories – beautiful-positive, beautiful-negative, ugly-positive, and ugly-negative. fMRI procedure. The scanning session comprised 4 event-related runs. The stimulus set of 64 painting images, was divided into 2 groups and presented twice in separate runs, once for the aesthetics judgment and again for emotional appraisal. The order of 4 runs was randomized. The order of stimuli in each block was counterbalanced. Figure 1 shows the experimental paradigm. fMRI data acquisition and analysis. Scanning was performed using a Siemens Magnetom Espree 1.5 Tesla MRI System with Head Marix A Tim Coil (TR: 2000ms, TE: 35ms, FOV: 240mm, slice thickness: 5mm, flip angle: 90°, echo spacing: 0.67 ms, FOV: 240mm, matrix size: 64 X 64). Statistical analysis was performed with SPM5 (Wellcome Department of Imaging Neuroscience, London, UK).

Results and Discussion: 1) Brain areas associated with emotional appraisal and aesthetic judgment. Results showed that areas including left middle frontal gyrus, left putamen, and right caudate nucleus showed greater activation for emotional appraisal compared to aesthetic judgment. Those areas are parts of the well-known emotional processing networks (Kim, S., 2007). In contrast, right medial frontal gyrus showed greater activation for aesthetic judgment compared to emotional appraisal. Previous studies have shown this area's involvement in

preference judgment (Paulus, M., 2003). We also found shared neural mechanisms between emotional appraisal and aesthetic judgment; the conjunction analysis revealed that pre- and post-central gyri as well as thalamus (Fig.2) are involved in both aesthetic judgment and emotional appraisal. 2) Brain areas specifically associate with “beautiful-negative” compared to “beautiful-positive”. The left anterior and the right posterior portions of the cingulate cortex and right parahippocampal gyrus showed greater activation for paintings judged to be beautiful-negative than for paintings judged to be beautiful-positive. (Fig.3) The opposite contrast didn't leave any statistically significant activation. Posterior cingulate and parahippocampal gyrus were found to be related to negative emotional contents in music (Blood, A., 1999) and the anterior cingulate is known to be related to reward expectation (Shidara, M., 2002).

Conclusions: This study identified both shared and differential neural networks involved in emotional appraisal and aesthetic judgment. The results suggest that those two core processes in experiencing art are closely related each other, but not identical. This study also found brain areas involved in experiencing sad but beautiful paintings, which implies beauty and positive emotion do not go hand in hand all the time.

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