

Canessa N, Motterlini M, Di Dio C, Perani D, Scifo P, Cappa SF, Rizzolatti G. [Understanding others' regret: a fMRI study](#). PLoS One. 2009 Oct 14;4(10)

Abstract

Previous studies showed that the understanding of others' basic emotional experiences is based on a "resonant" mechanism, i.e., on the reactivation, in the observer's brain, of the cerebral areas associated with those experiences. The present study aimed to investigate whether the same neural mechanism is activated both when experiencing and attending complex, cognitively-generated, emotions. In order to shed light on the question of whether the engagement of a resonance mechanism when attending someone else's experience of regret is affected by the individuals' empathic aptitude, we compared brain activations of females and males, under the assumption that females are more empathic than males. A gambling task and functional-Magnetic-Resonance-Imaging (fMRI) were used to test this hypothesis using regret, the negative cognitively-based emotion resulting from an unfavorable counterfactual comparison between the outcomes of chosen and discarded options. Do the same brain structures that mediate the experience of regret become active in the observation of situations eliciting regret in another individual? Here we show that observing the regretful outcomes of someone else's choices activates the same regions that are activated during a first-person experience of regret, i.e. the ventromedial prefrontal cortex, anterior cingulate cortex and hippocampus. These results extend the possible role of a mirror-like mechanism beyond basic emotions. Behavioral data from the BEES showed that the mean scores for our participants in study 1 were 34.83 (s.d.=16.75) for females and 19.33 (s.d.=18.39) for males. These data were representative of the normal Italian population (female mean=37, s.d.=18; male mean=21, s.d.=18; [14]) and revealed a significant gender difference, females being more empathic than males (Kolmogorov-Smirnov test for normality: $d=0.091, p>0.2$; two-sample t-test, $N=24, t(22)=2.15, p=0.042$). Consistent with these results, direct gender comparisons carried out in the parametric statistical maps of the third-person task (OP *minus* OF) revealed stronger activations for females than males in the ventromedial PFC, in ACC and in portions of the parietal cortex bilaterally, including the somatosensory cortex and the inferior parietal lobule. This resonant emotion may represent a drive for behavioral reorganization even when attended in somebody else's experiences.