

How does empathy activate reward regions? A fMRI study in healthy subjects and psychiatric patients with somatization disorder.

M. de Greck & G. Northoff

Background: Empathy as the ability to share emotions of others is disturbed in many psychiatric diseases like e.g. depression or somatization disorder. In the latter difficulties in the perception of emotional states, of oneself as well as of other's, lead to somatic symptoms which can be well treated with psychotherapy focusing on emotional recognition and differentiation. Neural correlates of empathy have recently been investigated by Singer et al. (2006) who among other regions observed strong involvement of reward-circuitry like ventral striatum (VS) during empathy. However, the exact neural relationship between empathy and reward remains unclear.

Aims: The main aim of our study is to investigate the neural activity in reward circuitry that is induced by empathy. We want to investigate this in healthy subjects as well as in patients with somatization disorder patients before and after in-patient psychotherapy. Our hypotheses are threefold: First, we expect changes of neural activity in reward regions (mainly VS) during empathy of emotional faces. Second, we assume that the somatization disorder patients show reduced neural activity during gambling as well as reduced activity during empathy in reward regions. Third, we hypothesise enhanced effects of empathy-induced neural activity in reward circuitry in the patient group after in-patient psychotherapy.

Paradigm: Our paradigm provides four different tasks.

1. A monetary gambling task in which subjects gamble about their salary (modified after Reuter et al 2005). Subjects are asked to bet for the orientation (horizontal or vertical) of the next presented picture. They have a 1:1 chance to gain or lose parts of their salary. During this task smoothed pictures with unrecognizable emotions are presented.
 2. A task in which subjects should empathize with presented emotional face pictures. Subjects are to determine the orientation of the next picture, which will be presented in the requested orientation. The picture contains an emotional face from the Ekman-Series including happy, neutral and angry faces. Subjects are instructed to empathize with the presented person.
 3. A combination of gambling and empathy. Three arrangements are possible, the gambling event can fit to the presented emotion (e.g., win with happy face), the gambling event and the presented emotion can be incongruent (e.g., win with angry face), and the presented emotion is neutral.
 4. A control task. In these trials subjects shall determine the orientation of the next picture, the presented pictures show smoothed faces with unrecognizable emotions though.
- In addition to this we present a baseline and a short motor task.

fMRI: We plan to conduct the study on the 1.5T GE-Scanner at the Zenit. 23 Slices of 5 mm thickness, 1 mm gap. TE 35 ms, TR 2000 ms, flip angle 80°. 6 runs with 275 volumes.

Data analysis: We want to analyze the functional fMRI data using spm2 and marsbar. As a first step we want to localize each subjects reward regions using the t-contrasts: win > lose, win > control, lose > control. In a second step, we want to examine the fMRI signal changes in these reward regions during the empathy tasks thereby comparing the differences between the empathy tasks (i.e. happy faces, neutral faces and angry faces) and their interactions with the reward task. This shall be done first for healthy subjects. Secondly between-group differences between healthy and somatization patients as well as in-group differences before and after psychotherapy shall be analysed using ANOVA.

Cooperations: Abteilung für Psychosomatik and Psychotherapie (J. Frommer), Fachkrankenhaus Uchtsprunge, Abteilung für Psychotherapeutische Medizin (C. Ulrich), Neuro2 (C. Tempelmann, L. Niehaus).