

Study proposal:

Amygdala responses to emotional facial expression: A high resolution fMRI study

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Background:

The human amygdala has originally been described as a ‘fear module’ and indeed lesion studies suggest that intact amygdalae are critical for the recognition of fear in facial expressions (1) as well as for the ability to subjectively experience fear (2). However, functional magnetic imaging (fMRI) studies reveal amygdala responses to a much wider variety of emotional stimuli, and specifically for facial expressions activations have been also described for happy, angry and disgusted facial expressions (3), leading to the suggestion that the amygdalae may primarily respond to an arousal dimension of emotion, rather than to specific emotional categories (4). To account for the variety of reports of amygdalae activations to emotional stimuli, it has also been suggested that amygdala responsiveness can be tuned by situational demands, leading to a conceptualization of amygdalae as a general ‘relevance detector’ (5). More recently, with the advent of higher field intensities in the fMRI as well as with more fine-grained neuroanatomical regional characterization in non-human primates (6), the possibility has also been raised, that different sub-regions of the amygdalae respond to different emotional categories (7). The present study aims to characterize human amygdalae responses to different emotional facial expressions in a gender decision task utilizing high-field (7T) fMRI technology. Results are expected to identify category-specific responses to emotional faces in the human amygdalae, clarifying some of the most controversial issues in the field.

Method:

8 students (4 male) will participate in return for either course credit or monetary compensation.

40 different face identities (20 male, 20 female) will be presented in seven different facial expressions (happy, surprised, neutral, fearful, angry, disgusted, and sad) the so-called basic facial expressions, resulting in 280 trials. On each trial, a face-stimulus will be briefly presented (200 ms), followed by a mask, and participants will be asked to decide by button-press, whether the face shows a male or a female person. In the fMRI, not emotion-related tasks have been shown to result in stronger activations than tasks, where emotion is task-relevant.

The experiment will be divided into 8 blocks of 35 (5x7expressions) trials, with approximate block duration of 4 min. This will allow participants to rest and may help to facilitate implementation of pattern classifier algorithms (leave one out cross-validation). Post experimentally, participants will be asked to rate emotional intensity and valence of subsets of the faces and to assign category labels to the faces. This will serve to provide stimulus intensity ratings as regressors to test the impact of arousal on amygdalae activation. Category assignments will serve to assess inter-rater consensus as to emotional expressions, allowing for exclusion of potentially ambiguous stimuli.

Data analysis: Data analysis will focus on multidimensional scaling (8 INDSCAL (Carroll und Chang, 1970) as implemented in PyMVPA, Hanke et al., 2009) to detect expression-dependent amygdalar activation pattern differences .

#### References:

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