Exposé

The impact of emotions on our thoughts, memory, concentration, decisions and behavior is well known and part of everyday life experience. Human beings are daily confronted with the perception of, the interpretation of and the proper reactions to different emotional facial expressions and emotional situations. The capability to distinguish between different emotional facial expressions is developed during early childhood and grows until young adulthood (Thomas et al., 2001).
The present study focuses on the processing of emotional faces and on the emotional modulation of cognitive tasks. Therefore, we will conduct two different studies:

1. Neuronal correlates of the perception of dynamic and static emotional expressions

In recent decades, the interest in studying the neuronal processing of emotions was predominantly performed via static emotional facial expressions (e.g. Ekman & Friesen, 1976). FMRI studies revealed the medial inferior prefrontal cortex, the ACC, the fusiform gyrus, the amygdala (fear; Morris et al., 1998), anterior insula (disgust; Phillips et al., 1997) (for a review, see Phan et al., 2002, Adolphs, 2002; etc.) as part of the neuronal network for face perception and regulation of emotion in adults.

However, only few studies included dynamic emotional stimuli which apparently appear to be ecologically more valid, more natural and more vivid (Sato et al., 2004) because they convey more facial details fascilitating appropriate emotion recognition and social interactions (Sato et al., 2004; Kilts et al., 2003). Compared to photos, dynamic emotional stimuli result in a generally stronger activation in distinct emotion-processing areas like the amygdala, fusiform gyrus, prefrontal cortex, etc. in adults (Labar et al., 2003, Sato et al., 2004).

2. Neuronal correlates of the emotional modulation of cognitive processes.

There is growing evidence that emotions modulate cognition and can either enhance or inhibit the performance of cognitive tasks (e.g. Gray et al., 2002, Maxwell et al., 2005, Schimmack & Derryberry, 2005). Maxwell et al. (2005) showed a lower inhibition accuracy in a go/nogo task for simultaneously presented angry compared to neutral and happy faces. Schimmack and Derryberry (2005) studied the influence of emotional stimuli (sexual, violent, snake pictures) which were simultaneously presented with 2 different cognitive tasks (line detection, math problems). Stronger stimuli derived arousal scores of the stimuli correlated with higher interference induction in cognitive tasks. Gray et al (2002) reported of a bilateral dorsolateral prefrontal area integrating emotion and cognitionbased on a fMRI working memory paradigm..

Our first fMRI study compares the neuronal correlates of the perception of static versus dynamic emotional facial expressions with a new stimulus database in adults within one fMRT session. The videos begin with an actor looking to the right or left with a neutral expression, turning to the front and immediately starting to demonstrate one of three emotional expressions (happiness, neutral, disgust). Forty female faces per emotion and condition (dynamic [videos] vs. static [photos]: 2*120 Stimuli) are presented in a pseudorandomized non-stationary order during four blocks adjourned by a stimulus-response-reaction-compatibility task of each 40 stimuli in order to keep the subjects alert. Videos and photos are presented in separate blocks and in a counterbalanced order.

The present study aims to investigate common neuronal correlates of the emotion perception network and to distinguish between the processing of static and dynamic stimuli. Stronger activations are expected for dynamic stimuli.

The second experiment will use the same above mentioned video sequences with the same emotional expressions (smile, neutral, disgust) in an fMRI as well as an EEG study. The start of the emotional expression of the face after turning to the front from the right or left is paired with an arrow displayed for 150 ms pointing in or against the direction of the previous turning side of the face.

The goal of this study is to evoke two kinds of conflicts: 1. the direction of the turning interferes with the displayed arrow (e.g. turning from the right interferes with an arrow pointing to the right and vice versa) resulting in longer reaction times and possibly a higher error rate. ACC and dorsal and medial prefrontal activation is expected. 2. the cognitive task is hypothesized to be modulated by the emotional valence of the face. The proposed direction of these effects is of explorative nature because the current opinion of emotional influence on cognition is currently still under debate. Generally spoken, prolonged reaction times will be expected for emotional videos assuming those capturing more attentional resources than neutral faces. The subjects are supposed to inhibit prepotent response tendencies.

In general, after the functional MRT and EEG session respectively, the subjects rate the emotional expressions of the videos and pictures according to their arousal, valence and naturalness outside of the scanner.

The sample size comprises 40 subjects (20 females, 20 males, between 19 and 30 years) in both experiments after giving informed consent. A following fMRI-session with adolescents (age 12 and 14) is planned for the second study.

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