

## Face Processing in Social Anxiety: Insights from MEG studies

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Social anxiety disorder is one of the most prevalent anxiety disorders. Socially anxious individuals show enhanced attunement to signals of social threat, such as those conveyed by emotional facial expressions and postures. Due to the importance of emotional facial expressions in social interaction, several studies explored their processing in social anxiety disorder. fMRI studies consistently show that, compared to healthy controls, socially anxious patients present hyperactivation of limbic structures (amygdala, insula, anterior cingulate cortex). However, fMRI studies do not provide sufficient temporal resolution to indicate the dynamics of these neural processes. Behavioral studies of face processing in social anxiety suggest an initial hypervigilance and consequent avoidance of threat, but since they are based on the end-product of processing (mainly reaction times), the findings of those studies reflect only indirectly the early mechanisms of face processing in social anxiety.

We used magnetoencephalography (MEG), which provides both temporal and spatial resolution to investigate the temporal unfolding of neural activity in the following regions of interest: the fusiform gyrus (FG, considered to be specialized in face-processing), the insula (involved in processing of emotional content of emotional facial expressions), and the dorsolateral prefrontal cortex (DLPFC, involved in higher order executive functions and cognitive control).

In a series of studies we socially anxious patients and healthy controls with dominant, angry, happy, submissive and neutral faces. Participants performed a gender-categorization task while undergoing a MEG recording, using a whole-head MEG consisting of 248 magnetometers. Analysis was performed using a SAM beamformer applied to the event-related magnetic fields.

Analyses revealed that at an early processing stage (130-200 ms post-stimulus) the insula and right FG responded differentially to facial expressions. The effect on the right FG was observed mainly on socially anxious participants and not on controls. Most surprisingly, socially anxious individuals showed reduced activity at early processing stages in the right FG as well as in the right DLPFC. This pattern was reversed at later stages (300-500 ms) with socially anxious showing greater activation than controls.

The combination of high temporal resolution with good spatial resolution offered by MEG revealed the abnormal pattern of neural activation during face processing in social

anxiety, characterized by an initial under-activation followed by a later over-activation in the right FG and the right DLPFC. This seems to indicate an early sub-optimal cortical face-processing in social anxiety, and a late recruitment of the FG in order to compensate for the initial sub-optimal processing. The late frontal over-activation could be associated with attempts of cognitive control and disengagement difficulties in the face of the social stimuli. The findings are discussed in relation to previous behavioral and imaging reports and possible implications for treatment.