

DOMINANCE PROCESSING IN SOCIAL ANXIETY – A MEG STUDY

Sharon Riwkes, Eva Gilboa-Schechtman, Abraham Goldstein
Department of Psychology and Gonda Brain Research Center, Bar-Ilan University



INTRODUCTION

Models of social anxiety disorder (SAD) posit that socially anxious people are characterized by a hyperactive dominance system and are overly attuned to signals of social threat [1]. Among the most common cues of social threat are facial expression and facial posture. There is behavioral and imaging evidence for abnormal processing in SAD of facial expression [2] and facial posture [3], involving both hyper-vigilance for and avoidance of threat cues. However, the exact mechanism and its temporal dynamics are not known.

AIM: The aim of this study was to examine the neural activity related to social threat cues perception using magnetoencephalography (MEG). Specifically we investigated whether SAD and cue type elicit different patterns of temporal activity in brain regions related to basic face perception and in higher-level areas.

METHOD

Participants

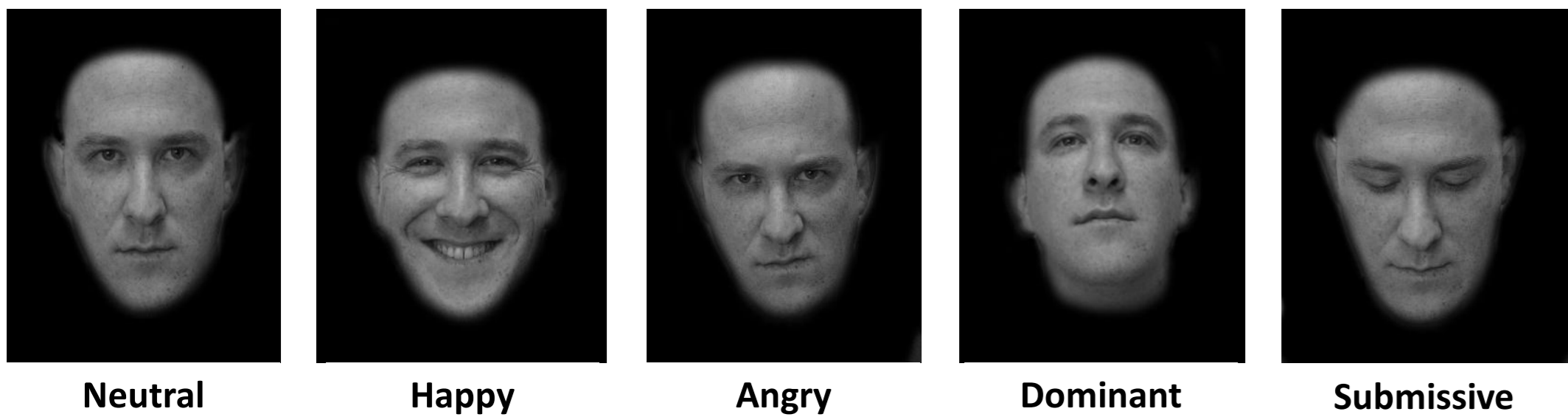
Volunteers diagnosed with SAD (n=12) using the Structured Clinical Interview for DSM-IV (SCID), and controls matched for age and gender (n=12) were recruited. SAD participants scored significantly higher than controls on two well-validated measures of social anxiety severity: the Lebowitz Social Anxiety Scale and the Fear of Negative Evaluation scale [72.3 (26.2) vs. 15.2 (8.4) and 25.4 (4.3) vs. 7.58 (6.0), respectively].

Stimuli

Photographs of 5 male and 5 female faces, each in 5 facial configurations: neutral, angry, happy, dominant and submissive (see figure below).

Task

Participants were requested to categorize the gender of each facial stimulus. Each stimulus was presented 10 times, 100 trials for each expression (500 in total). Each trial began with a fixation cross displayed for 800-1200ms. The stimulus was displayed for 1000ms followed by a "?" that remained on screen until the response was made.



* This work was supported by the Israeli Science Foundation grant 455-10 awarded to E. Gilboa-Schechtman, and the Israel Foundations Trustees grant 29/2010 awarded to S. Riwkes.

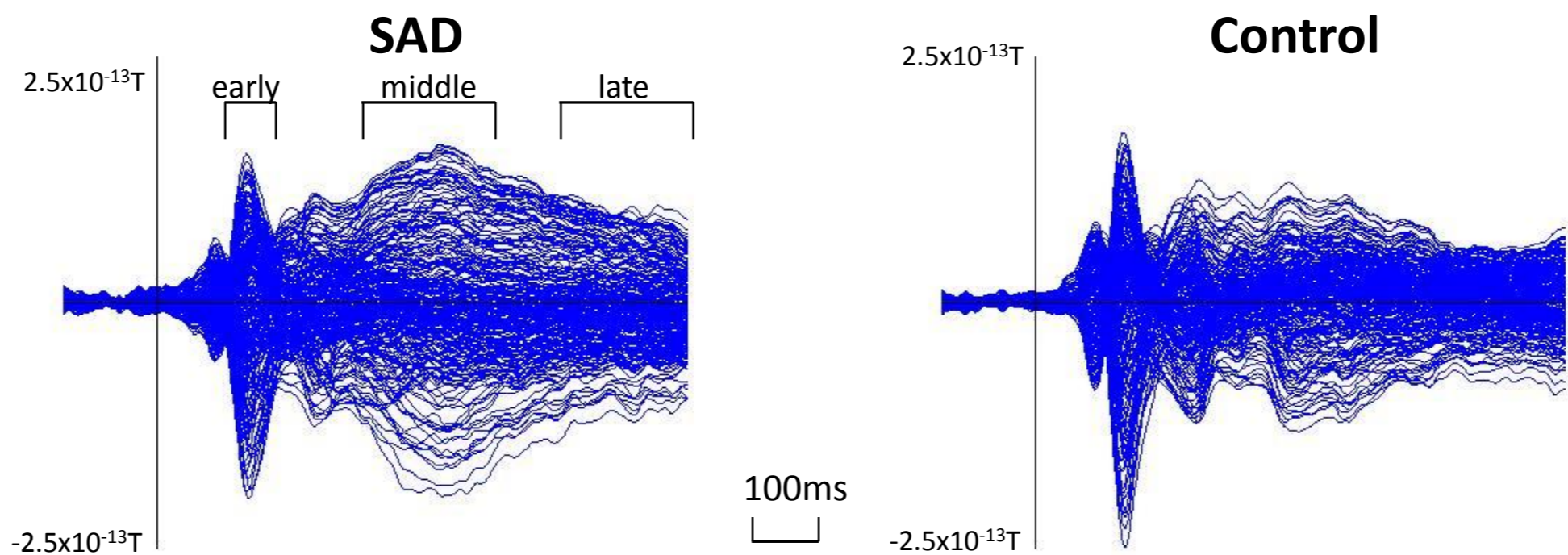
MEG recordings and analysis

A whole-head, 248-channel magnetometer array (4-D Neuroimaging, Magnes 3600 WH) was used in a magnetically shielded room. Reference coils located at a distance above the head oriented by the x, y and z axis were used to remove environmental noise. The data was digitized with a sample rate of 1017Hz and an online 1-400Hz band-pass filter. Data was filtered offline (1-40Hz), segmented into 1s epochs with a 150ms pre-stimulus baseline. Segments containing excessive artifacts were removed.

Sensor level averages were used to derive the time windows of interest. An event-related beamformer (SAMerf) was used for source estimation. All segments were used to derive the SAM covariance matrix and weights which were then applied to the averaged signal for each condition. Functional images were co-registered with a template MRI adapted to individual head shapes. Group analyses were performed using AFNI (3dttest, 3dANOVA3).

RESULTS

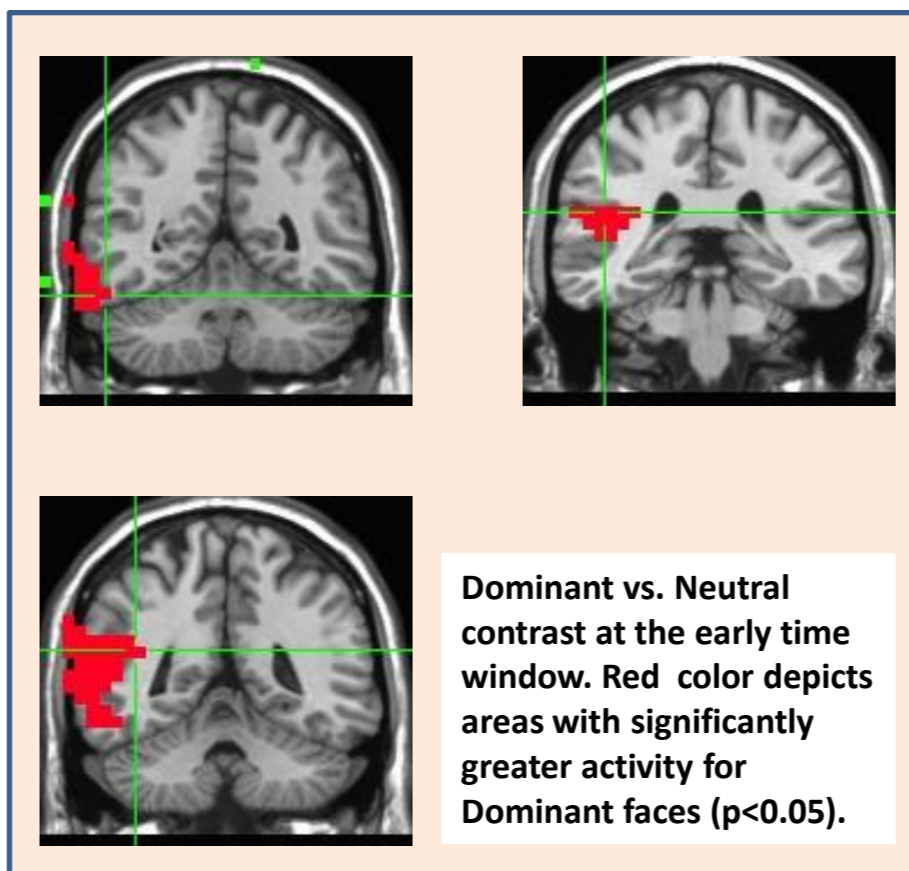
Sensor-level analyses revealed three main time windows of activity: The early stage (130-200ms) which encompassed the N170m component, a middle stage (300-500ms), and a late component (600-800ms).



Facial expression

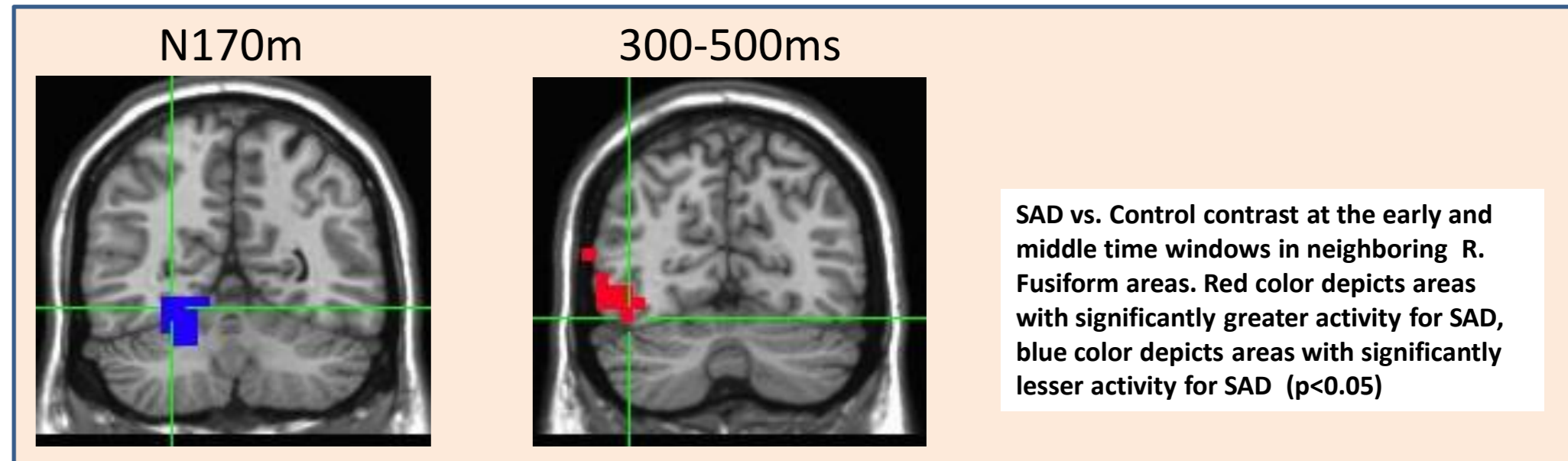
Early time window: cues of social threat (Angry, Dominant and Happy) elicited increased activity relative to Neutral faces at the R. Insula ($p=0.0082$, $p=0.0095$, $p=0.0046$) and R. Superior Temporal Gyrus ($p=0.009$, $p=0.0098$, $p=0.0014$). Dominant faces also elicited greater activity at the R. Fusiform Gyrus ($p=0.0026$) and R. Middle Temporal Gyrus ($p=0.0026$).

Late time window: Angry and Happy faces elicited greater activity at the R. Middle Frontal Gyrus relative to Neutral ($p=0.0097$, $p=0.0038$). Submissive faces showed lesser activity than Neutral faces at the same region ($p=0.007$).

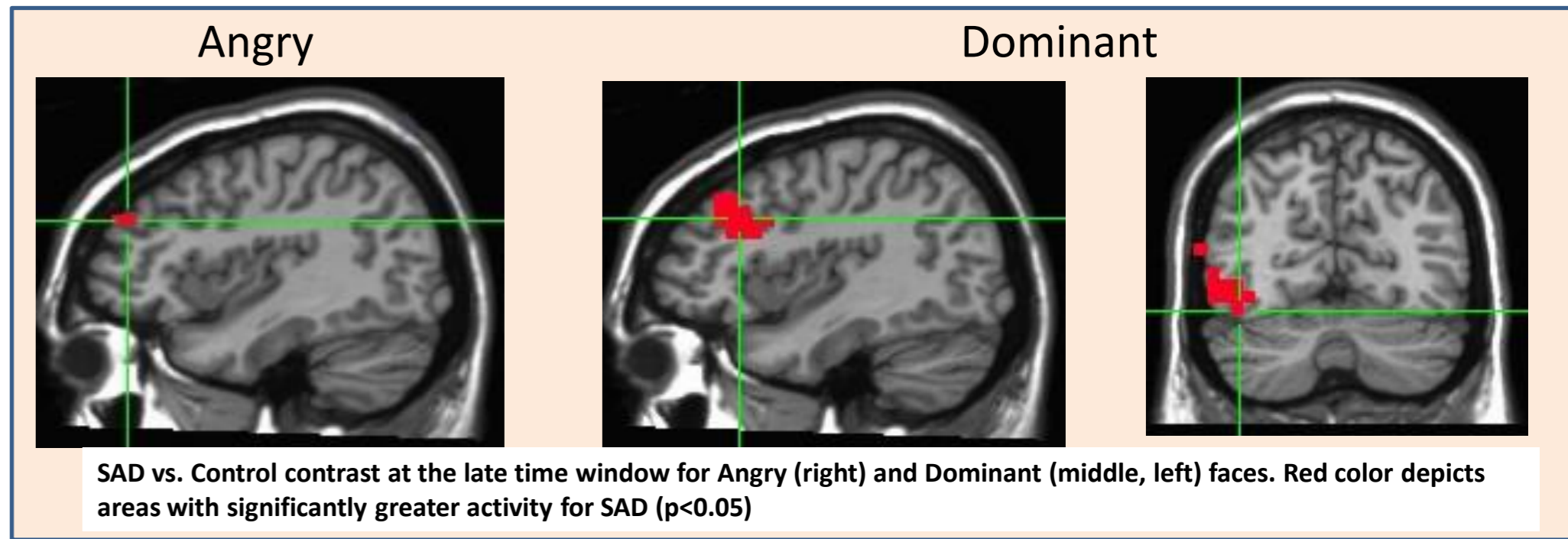


Social Anxiety

The SAD group displayed lesser activation than the controls at the R. Fusiform during the N170m window for all facial expressions ($p=0.0132$). This pattern was reversed at the middle stage (300-500ms) with SAD showing greater activation in that region ($p=0.0142$).



At the late time window, the SAD group showed greater activity than controls at the R. Middle Frontal Gyrus for all but Neutral facial cues ($p=0.0051$). In addition, they showed greater activity at the R. Inferior Frontal Gyrus for Dominant faces ($p=0.0018$).



CONCLUSIONS

The findings indicate that SAD participants show less activation than controls in face perception areas at the early stages of processing. Nevertheless, they show increased activity at later stages in face perception regions as well as in frontal areas in response to social threat expressions. These data suggest that SADs exhibit less initial activation in primary facial processing areas, but show more extensive processing at later stages. Our findings also suggest that facial expression and facial posture modulate processes at the early stages of face perception. Combined, our findings highlight the importance of studying the temporal unfolding of neural activity in response to socially relevant cues.

[1] Trower, P., Gilbert, P., & Sherling, G. (1990). Social anxiety, evolution, and self presentation: An interdisciplinary perspective. In H. Leitenberg (Ed.), *Handbook of social and evaluation anxiety* (pp. 11-45). New York and London: Plenum Press.
[2] Schneier, F. R., Kent J.M., Star A., Hirsch J. (2009). Neural circuitry of submissive behavior in social anxiety disorder: A preliminary study of response to direct eye gaze. *Psychiatry Research: Neuroimaging*, 173, 248-250.
[3] Chiao, J. Y., Adams, R. B., Tse, P. U., Lowenthal, W. T., Richeson, J. A., & Ambady, N. (2008). Knowing Who's Boss: fMRI and ERP Investigations of Social Dominance Perception. *Group Processes & Intergroup Relations* 11, 201-214.

