Impairment in Working Memory due to Social Evaluative Threat is Mediated by Activity in the Intraparietal Sulcus

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INTRODUCTION

Background
• Working memory (WM) is a construct that involves multiple components including maintenance and executive processing.
• The N-back task is a common task of WM that involves the following processes: coding, maintaining and continuous updating of item and order information.
• Social Evaluative Threat (SET) is a potent psychosocial stressor that is characterized by the possibility of being evaluated negatively by others. It elicits a robust cortisol response (Dickerson & Kemeny, 2004), and it has been shown to impair N-back performance (Schoofs et al., 2008).

Major Questions
Q1. What areas of the brain mediate the effect of SET on N-back impairment?
Q2. What areas of the brain support N-back performance during SET?

RESULTS

Fig 2a. N-back Task Design: 2-back and 3-back blocks were administered in ABBA or BAAB order. SET subjects were told that the N-back task was a test of general intelligence and that it would always succeed later in the trial. They were also provided with negative feedback at the end of each run. Control subjects were not given additional instructions or feedback.

Fig 2b. N-back Trial Schematic (3-Back): Subjects were instructed to respond "Not to Non-targets and "Yes" to Targets. There were 2 types of Non-targets, Lure and Nontargets. In a 3-back block, Lures were defined by a 2-back and 4-back match.

METHODS

Participants: N = 21; 10 SET (4 male), 11 Control (6 male); mean age = 22.94 (sd = 4.24); exclusion criteria include: psychiatric, neurological, immune system, and endocrine system disorders.

Study Procedure: See Fig 1 (below) for details.

N-back Task (2- and 3-back): See Figs 2a,b (next panel) for details

Imaging Acquisition: A Philips Achieva 3T scanner was used to acquire gradient-echo EPI BOLD images with the following parameters: TR = 2 s, TE = 20 ms, slices = 37, voxel size 2 x 2 x 3 mm.

Imaging Analysis: Using SPM5, imaging data were preprocessed using standard procedures and single level models were estimated using a canonical HRF and the following predictors: 3-back Targets, 3-back Lures, 3-back Nontargets, 2-back Targets, 2-back Lures, 2-back Nontargets, errors. Mediation parametric mapping and robust regression were employed at the second level.

REFERENCES

A1: We replicate previous work (Schoofs et al., 2008) showing that SET impairs N-back performance. Deactivation of bilateral IFG in WM regions was demonstrated in a subset of controls (IFG region, prefrontal cortex) in a previous study.

SUMMARY

A1: We replicate previous work (Schoofs et al., 2008) showing that SET impairs N-back performance. Deactivation of bilateral IFG in WM regions was demonstrated in a subset of controls (IFG region, prefrontal cortex) in a previous study.

A2: The precursor, a region that has been associated with shifting attention, appears to be important to aiding performance during SET.

A3: The negative effect of SET does not appear to be due to changes in cortisol. Those in the SET group who showed a robust increase in cortisol performed better and activated key WM regions to a greater degree than SET subjects who did not. The role of cortisol may be protective which has been observed elsewhere in memory (Garfinkel et al., submitted) and mood research (Het & Wolf, 2007). Follow up analyses will investigate the role of state anxiety as a mediator of SET and N-back impairment.

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