

BACKGROUND

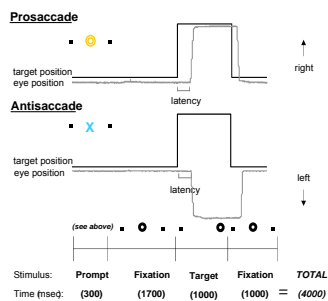
- Effortful cognitive activity correlates with decreased activity in a network of regions
- This network is known as the 'default mode' network (Raichle et al., 2001), and includes:
 - Ventromedial prefrontal cortex: orbitofrontal cortex and rostral anterior cingulate (rACC)
 - Posterior medial cortices, including posterior cingulate cortex (PCC) and precuneus
 - Dorsomedial prefrontal cortex (DMC), including parts of BA 8, 9 and 10
 - Posterior lateral cortices: inferior parietal cortex and superior temporal cortex
- Decreased activation may represent a reallocation of resources from emotional processing or interoceptive areas to ones important for cognitive functioning.
- Optimal performance correlates with the magnitude of decreased activity in this network (Simpson et al., 2001)
- Main Hypothesis:** Deactivation helps to prepare for optimal task performance
- We set out to test this hypothesis using event-related fMRI and a saccadic task
- Specific hypotheses:**
 - Deactivation will occur early during correct trials, consistent with a role in task preparation
 - Deactivation will not occur during error trials
 - Deactivation failure will correlate with individual error rate

METHODS

TASK

- Participants performed 6 runs of pseudorandomized antisaccade and prosaccade trials.

- Prosaccade:** automatic response of looking towards a suddenly appearing visual target.
- Antisaccade:** inhibition of prosaccade generation of the novel behavior of looking away from a target.



PARTICIPANTS

- 18 healthy controls (7 females, 11 males) with a mean age of 33 ± 11 years

BEHAVIORAL DATA

- Saccadic latency and directional accuracy of saccades.
- Antisaccade error rate = 8%

MRI DATA ACQUISITION

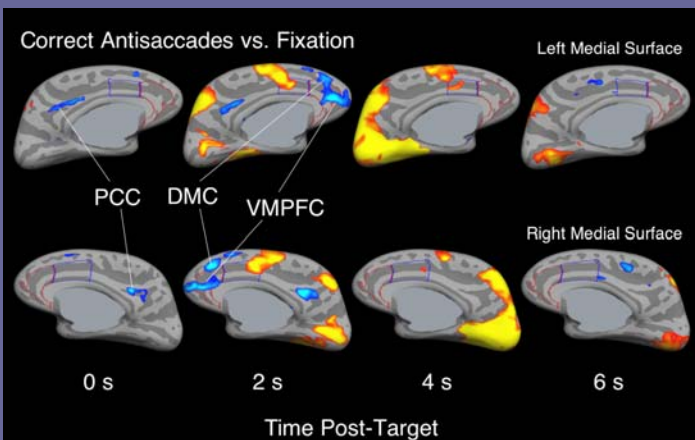
- 2 MP-RAGE, T1-weighted sequences (TR/TE/Flip = 7.25ms/3ms/7°) used for FreeSurfer cortical surface reconstruction/inflation to visualize activity inside sulci and to allow inter-subject registration based on sulcal-gyral pattern
- 20 5mm axial slices parallel to the AC-PC plane (3.13 X 3.13 X 5)
- Gradient echo, T2* weighted sequence (TR/TE/flip = 2000ms/30ms/90°)
- PACE online motion correction

DATA ANALYSIS

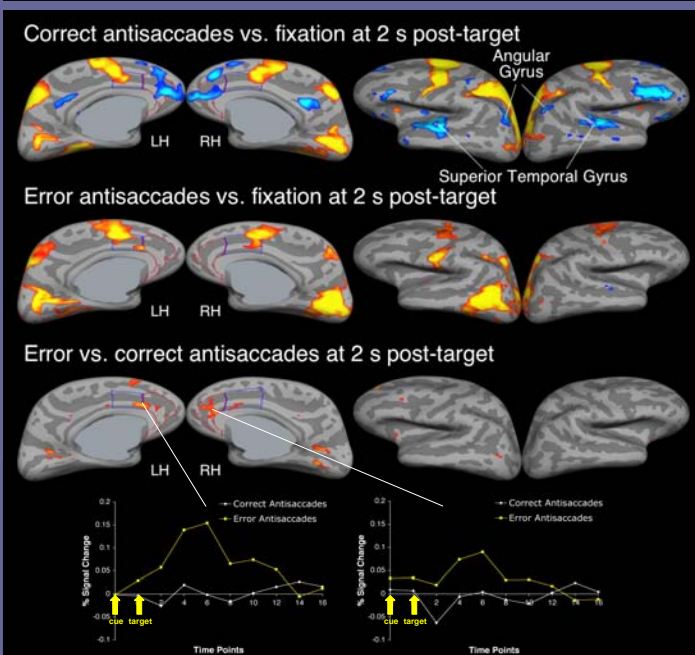
- Preprocessing: motion correction, intensity normalization, spatial smoothing
- Finite impulse response (FIR) model (FS-FAST) was used to estimate hemodynamic responses (HDRs) for 4 event types:
 - Correct and error prosaccades
 - Correct and error antisaccades
- Random-effects model
- Cluster size of 120 mm² of voxels where $p \leq .001$ set overall p-level at $\leq .05$
- Hypothesis 1:** Deactivation will occur early in correct trials:
 - Whole brain activation maps of **correct antisaccades vs. fixation** at 0, 2, 4 and 6 s post-target
- Hypothesis 2:** Deactivation will not occur during error trials:
 - Compared **error antisaccades vs. fixation**, and then **error vs. correct antisaccades** at time point when deactivation was maximal in correct trials.
- Hypothesis 3:** Error rate will correlate with deactivation failure:
 - Regressed individuals' number of errors onto the whole brain activity in the **error vs. correct contrast** at the time point when difference b/w error and correct trials was maximal.

RESULTS

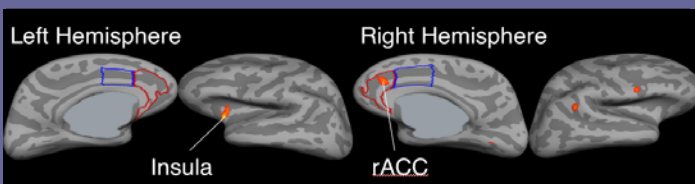
Hypothesis 1: Deactivation will occur early during correct trials



Hypothesis 2: Deactivation will not occur during error trials



Hypothesis 3: Individual error rate will correlate with deactivation failure



SUMMARY OF FINDINGS & DISCUSSION

- Deactivation occurred during correct trials, early in the time window, suggesting that it plays a role in optimizing performance.
- Deactivation did not occur during error trials, and a direct comparison of error vs. correct trials showed that this difference was significant in the right rACC
- Individual error rate was found to correlate with activity in the right rACC and insula.
- These results suggest that deactivation occurs during task preparation and is necessary for accurate task performance

REFERENCES

ACKNOWLEDGEMENTS & SUPPORT