Supplemental Materials

When less is more: TPJ and Default Network Deactivation During Encoding Predicts Working Memory Performance

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Signal pattern in other regions showing less signal for correct than incorrect trials during encoding. Do the other regions showing less signal for correct than incorrect trials display the same pattern of deactivation during encoding as TPJ? Although the analysis described in the main text (Figure 4A, main text) indicates that these regions must show *less* signal for correct than incorrect trials, it does not clarify whether this reflects changes in task-related activation, or changes in task-related deactivation. Thus, for each of the default network ROIs identified in the analysis above (Figure 4A, main text), we plotted activity for correct and incorrect trials separately (Figure 4B, main text). The overall default network map was partitioned using a peak-splitting algorithm such that peaks were considered as separate if they were more than 10 mm apart, thus permitting small foci to be examined (Michelon et al., 2003). The BOLD signal was averaged across all distracter trials given that at encoding subjects did not have awareness of the identity of the upcoming distraction. The black lines (Figure 4B, main text) show the average time-courses for correct (solid) and incorrect (dashed) trials averaged across all peak ROIs. Overall, time-courses for correct trials in the parcelated ROIs indicate a pattern of greater deactivation during encoding, consistent with the pattern observed in the TPJ ROI (Figure 3C, main text).

Do the areas showing more deactivation for correct than incorrect trials during encoding fall within the default network? Given the striking correspondence between figure 4A (main text) results and Fox et al. (2005) default network we used the default network map identified independently in the resting-state (obtained with permission from Fox et al., 2005) to examine if our findings fall within the default network as defined by Fox and colleagues (2005) (see black borders in Figure 4A, main text). Specifically, 60.25% of all voxels identified as less active for correct than incorrect trials during encoding (Figure 4A, main text) fell within the Fox et al. (2005) default network boundaries. To confirm this statistically we ran a binomial test for proportions and the 60.25% of spatial overlap between the two maps significantly exceeded the proportion expected by chance alone ($p<0.000001$, binomial test for proportions).

Additionally, deactivated foci shown in supplemental figure S2A and figure 4A (main text) had to meet a whole-brain $p<0.05$ correction in order to have the time courses evaluated ($Z>3$ and 13 contiguous voxels, as determined by in-house Monte Carlo simulations). Importantly, the time courses of the foci falling explicitly within the Fox et al. (2005) map boundaries showed the same deactivation pattern (Supplemental figure S2B). In addition, a similar, but attenuated pattern of deactivation was observed for correct trials when examining time courses extracted out of a-priori defined spherical ROIs (Supplemental figure S2C).

Supplemental Figure Captions

Figure S1. **Assumed HRF model components.** We used an assumed GLM approach (see Main Text) to estimate 5 different components of each trial: (1) Encoding phase (blue); (2) Pre-distracter delay phase (gray); (3) Distracter response (red); (4) Post-distracter delay phase (black); and (5) Probe response (green). Distracter response and post-distracter delay were modeled separately for each condition type (i.e. neutral, emotional, task-related and distracter-free trials) and all components were modeled separately for both low and high WM loads yielding a total of 22 estimates.

Figure S2. **Regions showing lower signal for correct than incorrect trials during encoding and Fox et al. (2005) default network ROIs.** (A) Outlines of default network map as defined by Fox et al. (2005) are shown using black borders. The overlapping foci showing less signal for correct than incorrect trials during encoding are shown in blue. Here, we show the foci using a $Z>2.5$ threshold demonstrating that even with a lower cutoff the foci are centered mainly around the default network. (B) The same pattern of deactivation at encoding for correct (green lines) versus incorrect trials (red lines) was observed for foci explicitly overlapping with the Fox et al. (2005) default network map. The black lines show the average across all peak ROIs for correct (solid) and incorrect (dotted) trials indicating less signal for correct trials during encoding, but no differences at the onset of the distracter. (C) Time courses extracted specifically from the 13 seed spherical ROIs based on the Fox et al. (2005) center of mass coordinates are shown. Overall, the pattern of deactivation for correct vs. incorrect trials during encoding is present, but attenuated.

Figure S3. **Right hemisphere overlap between complete TPJ seed connectivity map at encoding and Fox et al. (2005) map**. A flattened right hemisphere from the PALS atlas is shown with yellow regions marking the overlap between TPJ seed trial-based functional connectivity results at encoding (both positive and negative foci including both default network and fronto-parietal nodes) and the overall map defined by Fox et al. (2005) (including both default and fronto-parietal nodes). Prior to overlap calculations both maps were thresholded and corrected to meet a whole-brain $p<0.05$ false positive rate. Black borders demarcate the full extent of the map defined by Fox et al. (2005).

Figure S4. **Out-of-scanner behavioral results with distracter-free trials blocked.** Mean accuracy (expressed as % correct) is shown for task-related, emotional, neutral distracter conditions as well as distracter-free trials across two load levels (high load = 3 shapes, low load= 2 shapes). Results are shown for the out-of-scanner sample (N=25), which completed a version of the task where distracter-free trials were presented in a blocked fashion separately from the other distracter trials rather than being intermixed (as in the main text). Importantly, all the stimuli were identical to the ones used in the fMRI sample. In contrast to the mixed presentation, when subjects performed the blocked version of the task their performance on distracter-free was substantially better. Error bars represent +/- 1 standard error of the mean.