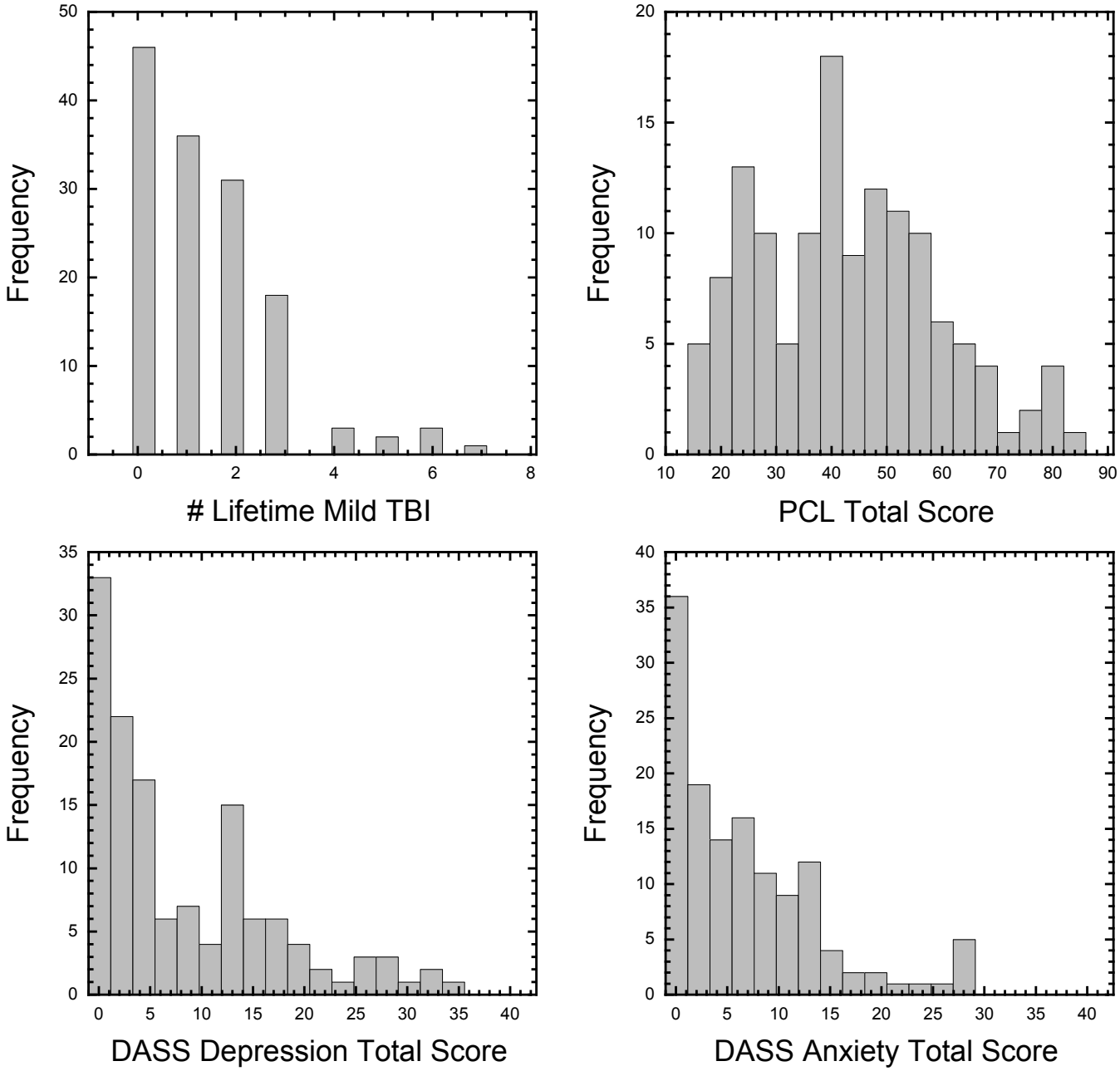
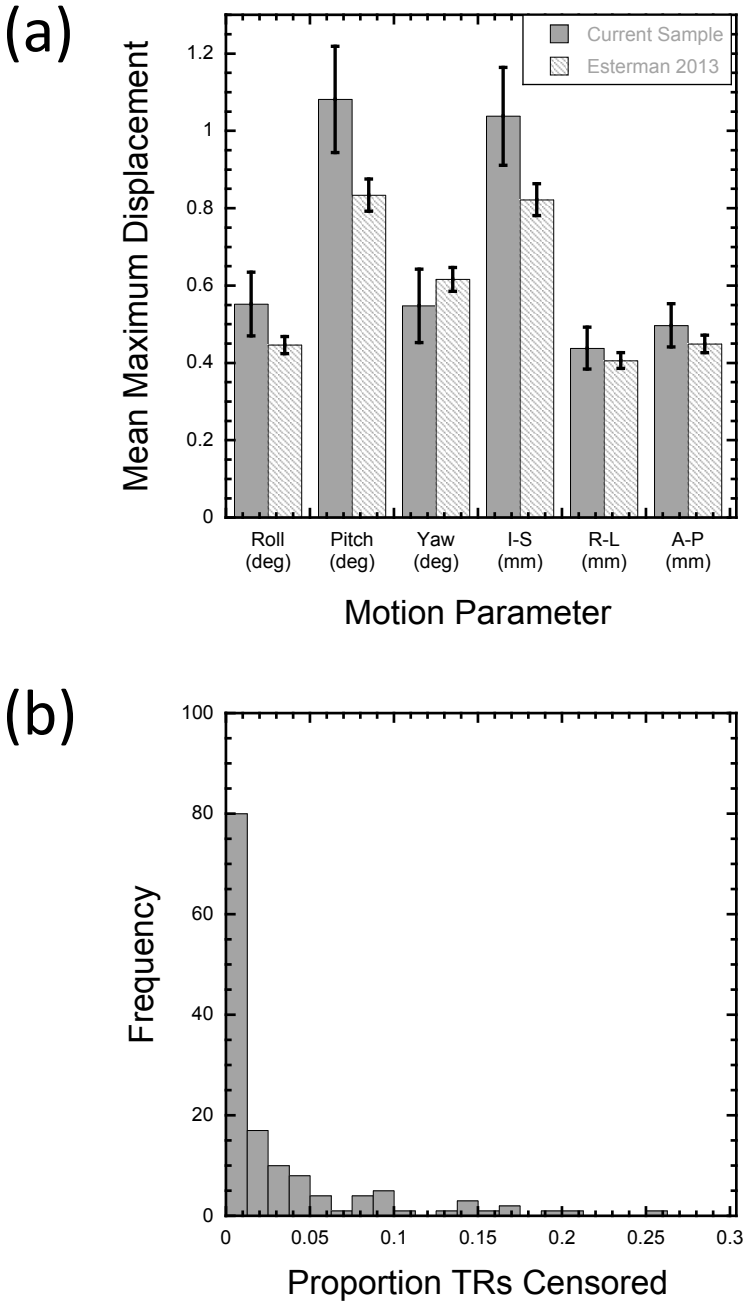
Supplementary Figure 1: Participant Clinical Assessments. The four bar graphs below show the distribution of scores for four common clinical issues faced by our Veteran sample (mild TBI, PTSD, Depression, and Anxiety) using self-report measures included in the TRACTS testing protocol. These include the number of lifetime mild traumatic brain injuries (TBIs). Note, mild TBIs are also referred to as concussions and include no period of loss of consciousness as seen in moderate or severe TBIs. The distribution from the PTSD Checklist (PCL) is a 20-item self-report measure that assesses the 20 DSM-5 symptoms of PTSD. The Depression Anxiety Stress Scale (DASS) is a self-report measure that is used to measure symptoms of Depression and Anxiety.



Supplementary Figure 2. Participant Motion During Scan. (a) The bar graph shows the mean maximum displacement for each of the six motion parameters measured over the course of the functional gradCPT run. Displacement was measured relative to the position of the head at the beginning of the scan. Errors bars show 95% Confidence Intervals. Mann-Whitney U tests show no difference in mean displacement for any of the six motion regressors (uncorrected $p > 0.05$ for all). (b) The histogram shows the proportion of TRs censored due to transient motion >0.5(mm or deg) for each of the 140 participants in the current sample across the gradCPT run.



Below we include Supplementary Tables that show the location of peak activations in the evoked analyses, the VTC correlation analysis, and the analysis examining the degree of VTC coupling and overall performance. For the evoked analysis, no table is generated for the correct omission (CO) maps (Figure 3a) given the large cluster sizes. Even with increased thresholding raising the nominal p-value to $p = 0.000001$, cluster sizes >1,000 were still observed limiting the utility of a table.

Supplementary Table 1: CE Map Cluster Table.

Clusters 1-13 were identified using a thresholding of $p = 0.01$, minimum cluster size = 81 voxels. To further explore Clusters 1 & 2, the threshold was increased to $p = 0.001$, minimum cluster size = 19 voxels in order to identify peak sub-clusters (A-H). The Peak Coordinates use RAI coordinate order.

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	6,859	-37.5, -13.5, 5.5	11.642	Bilateral Insula, Inferior Frontal Gyrus, & Thalamus
A	2,045	-37.5, -13.5, 5.5	11.642	Bilateral Insula and Thalamus
B	1763	1.5, -19.5, 38.5	11.154	Bilateral Cingulate, Medial Frontal Gyrus
C	563	58.5, 43.5, 23.5	7.005	Right Supramarginal Gyrus/ Inferior Parietal Lobule
D	316	-25.5, -46.5, 32.5	7.730	Right Superior Frontal Gyrus
2	3,158	-22.5, -40.5, 5.5	-6.683	Bilateral Anterior Cingulate, Paracentral Lobule, Left Superior Frontal Gyrus
E	596	4.5, 31.5, 56.5	-6.244	Bilateral Paracentral Lobule
F	333	-22.5, -40.5, 5.5	-6.683	Right Anterior Cingulate
G	178	1.5, -34.5, 29.5	-6.342	Left Anterior Cingulate
H	129	22.5, -4.5, 29.5	-5.871	Left Cingulate
3	632	58.5, 40.5, 29.5	8.322	Left Supramarginal Gyrus/ Inferior Parietal Lobule
4	386	22.5, -46.5, 29.5	7.747	Left Superior Frontal Gyrus
5	242	40.5, 73.5, 35.5	-5.704	Left Precuneus/Angular Gyrus
6	145	31.5, 49.5, -27.5	6.319	Left Cerebellum/Fusiform Gyrus
7	137	-28.5, 76.5, -33.5	-5.239	Right Cerebellum
8	128	-7.5, 67.5, 41.5	4.888	Bilateral Precuneus
9	121	-28.5, 88.5, -6.5	-5.079	Right Inferior Occipital Gyrus
10	107	-28.5, 10.5, 2.5	-6.230	Right Putamem
11	101	-34.5, 49.5, 2.5	-3.784	Right Parahippocampal Gyrus
12	92	-64.5, 19.5, 5.5	-5.131	Right Superior Temporal Gyrus
13	87	13.5, 64.5, 8.5	4.786	Left Cuneus

Supplementary Table 2: OE Map Cluster Table.
Clusters 1-6 were identified using a thresholding of $p = 0.01$, minimum cluster size = 81 voxels. To further explore Cluster 1, the threshold value was increased to $p = 0.001$, with minimum cluster size = 19 in order to identify peak sub-clusters (A-H).

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	3,459	-7.5, -19.5, 32.5	6.932	Bilateral Superior, Medial, & Middle Frontal Gyru, Cingulate, Insula, Left Thalamus
A	722	-7.5, -19.5, 32.5	6.932	Bilateral Cingulate
B	449	-34.5, -22.5, 11.5	6.255	Right Insula
C	164	31.5, -22.5, 11.5	6.697	Left Insula
D	92	52.5, -7.5, 17.5	5.448	Left Inferior Frontal Gyrus
E	77	-46.5, -31.5, 20.5	4.673	Right Middle Frontal Gyrus
F	76	37.5, 40.5, 26.5	5.305	Left Middle Frontal Gyrus
G	63	22.5, 1.5, 65.5	4.919	Left Superior Frontal Gyrus
H	21	7.5, 1.5, 5.5	4.506	Left Thalamus
2	609	-46.5, 37.5, 41.5	5.986	Right Supramarginal, Inferior Parietal Lobule
3	423	-10.5, 1.5, 26.5	-5.112	Right Cingulate, Caudate
4	340	13.5, 40.5, 11.5	-5.779	Left Posterior Cingulate/Thalamus
5	338	40.5, 40.5, 38.5	5.285	Left Inferior Parietal Lobule, Supramarginal
6	177	-7.5, 22.5, 2.5	5.069	Right Thalamus

Supplementary Table 3: CO-CE Contrast Map Cluster Table.
Clusters 1-12 were identified using a thresholding of $p = 0.01$, minimum cluster size = 81 voxels. For Clusters 1-3, the threshold value needed to be increased to $p = 0.0001$ in order to identify peak sub-clusters (A-E).

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	2,003	-28.5, 79.5, 26.5	6.810	Right Superior Parietal, Middle Occipital Gyrus, Lingual Gyrus, Fusiform, Parrahippocampal Gyrus
A	607	-28.5, 79.5, 26.5	6.810	Right Superior Parietal, Middle Occipital, Fusiform Gyrus
2	1,915	1.5, -28.5, 26.5	-8.831	Bilateral Anterior Cingulate, Medial Frontal Gyrus, Cingulate, Superior Frontal Gyrus
B	918	1.5, -28.5, 26.5	-8.831	Bilateral Cingulate Gyrus
C	106	19.5, -43.5, 26.5	-7.002	Left Superior Frontal Gyrus
3	1,604	46.5, 73.5, -3.5	6.495	Left Superior Parietal, Middle Occipital Gyrus, Lingual Gyrus, Fusiform, Parrahippocampal Gyrus
D	319	46.5, 73.5, -3.5	6.495	Left Fusiform, Middle Occipital Gyrus
E	92	25.5, 61.5, 47.5	5.367	Left Superior Parietal Lobule
4	701	28.5, -16.5, -6.5	-7.257	Left Insula, Inferior Frontal Gyrus
5	583	-37.5, -10.5, 5.5	-7.475	Right Insula, Inferior Frontal Gyrus
6	461	58.5, 40.5, 29.5	-6.341	Left Inferior Parietal Lobule
7	430	7.5, 10.5, 8.5	-5.350	Left Thalamus
8	420	-28.5, -4.5, 5.5	6.112	Right Putamen
9	413	-1.5, 73.5, 20.5	-5.008	Bilateral Cuneus
10	222	4.5, 34.5, 56.5	4.642	Bilateral Medial Paracentral Lobule
11	142	-19.5, -46.5, 32.5	-6.255	Right Superior Frontal Gyrus
12	122	25.5, -1.5, 8.5	6.549	Left Putamen

Supplementary Table 4: Pretrial Whole-Brain CO-CE Contrast Map Cluster Table.
Clusters 1-4 were identified using a Monte-Carlo permutation method setting t=1.96 and thresholding of p = 0.05, minimum cluster size = 353 voxels (see main text for details). To aid in visualization of subcortical and cerebellar voxels we include Supplementary Figure 3 below.

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	978	-16.5, -1.5, 14.5	4.770	Bilateral Thalamus, extending to Left Insula and Right Cingulate
2	861	-31.5, 22.5, 50.5	-5.350	Right Precentral Gyrus, extending to Left and Right Postcentral Gyrus
3	851	1.5, -49.5, -6.5	-4.829	Bilateral Medial Frontal/Anterior Cingulate
4	432	-31.5, 46.5, -30.5	4.018	Right Cerebellar Tonsil, extending up and predominantly in Fusiform Gyrus

Supplementary Table 5: VTC Map Cluster Table.

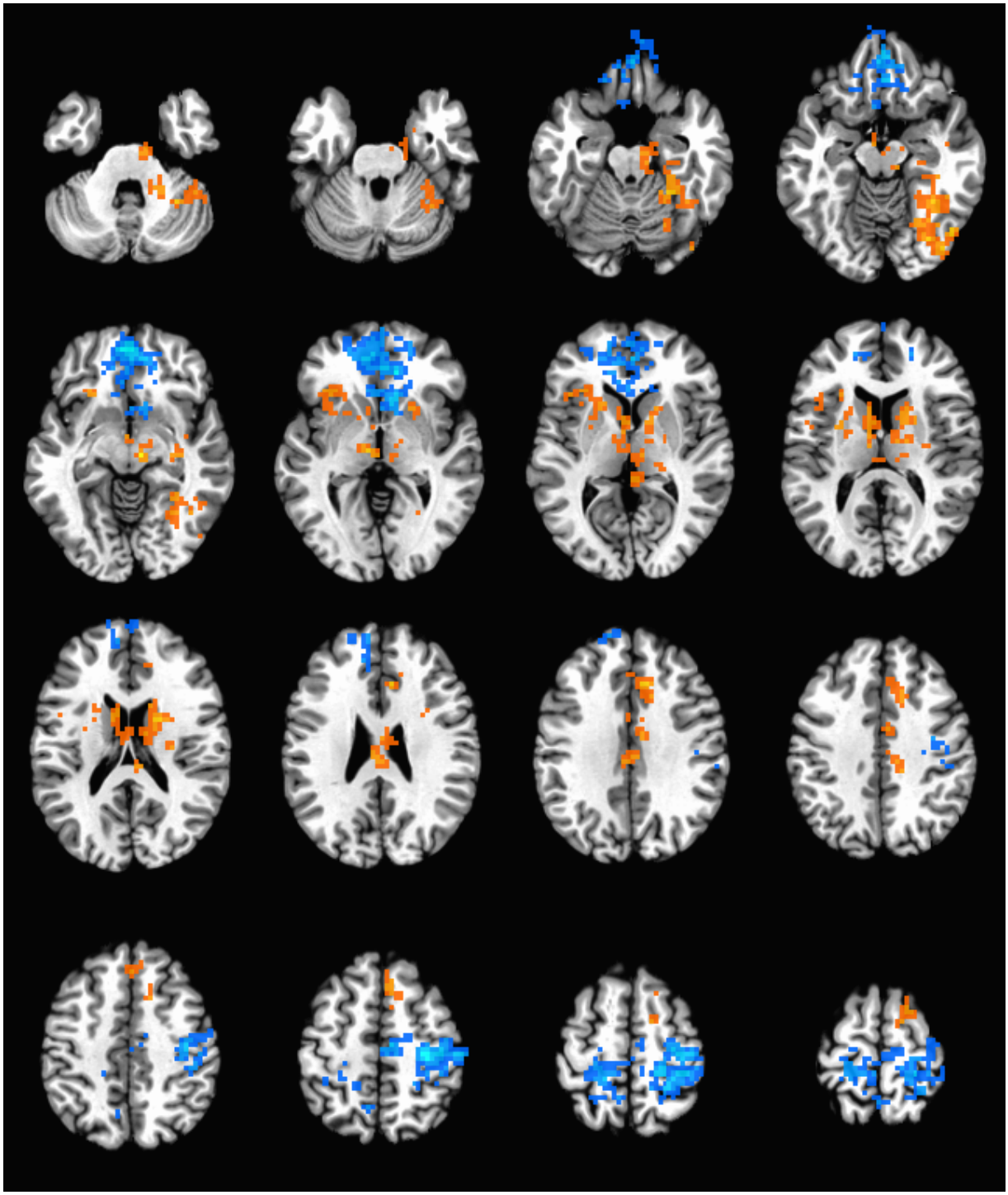
Clusters 1-13 were identified using a thresholding of $p = 0.01$, minimum cluster size = 81 voxels. To further explore Clusters 1 & 2, the threshold value was increased to $p = 0.001$, with minimum cluster size = 19 in order to identify peak sub-clusters (A-G).

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	6,305	-7.5, 1.5, 59.5	8.398	Bilateral Medial Frontal Gyrus, Cingulate Gyrus, Precentral Gyrus, Inferior Frontal Gyrus, Insula, Right Inferior Parietal Lobule
A	1,976	-7.5, 1.5, 59.5	8.398	Bilateral Medial Frontal Gyrus, Cingulate Gyrus, Middle Frontal Gyrus, Left Precentral Gyrus
B	463	-58.5, 16.5, 23.5	6.499	Right Postcentral Gyrus
C	367	28.5, -19.5, 14.5	7.785	Left Insula
D	79	-37.5, -37.5, 35.5	5.062	Right Middle Frontal Gyrus
E	29	-31.5, -49.5, 26.5	5.164	Right Superior Frontal Gyrus
F	27	34.5, -43.5, 26.5	5.283	Left Middle Frontal Gyrus
2	1,359	-1.5, 85.5, 17.5	-6.585	Bilateral Cuneus, Precuneus, Posterior Cingulate
G	698	-1.5, 85.5, 17.5	-6.585	Bilateral Cuneus, Cingulate, Posterior Cingulate
3	874	1.5, -67.5, 26.5	-5.181	Left Medial Frontal Gyrus, Bilateral Anterior Cingulate
4	851	28.5, 64.5, -6.5	6.471	Left Fusiform, Parahippocampal, Middle Occipital Gyrus
5	378	37.5, 85.5, 32.5	-4.547	Left Superior Occipital, Superior Parietal Gyrus
6	350	40.5, -7.5, -24.5	-4.799	Left Superior, Middle Temporal Gyrus
7	245	-31.5, -49.5, 26.5	5.164	Right Superior/Middle Frontal Gyrus
8	168	34.5, -43.5, 26.5	5.283	Left Superior/Middle Frontal Gyrus
9	134	-34.5, 34.5, 62.5	-4.675	Right Postcentral Gyrus
10	123	-49.5, 13.5, 8.5	-4.854	Right Superior Temporal Gyrus
11	112	16.5, 73.5, -33.5	-4.45	Right Cerebellum
12	98	25.5, 52.5, 41.5	5.325	Left Superior Parietal Lobule
13	98	-49.5, 79.5, 29.5	-4.143	Right Superior Occipital Gyrus

Supplementary Table 6: VTC-Performance (D') Correlation Map Cluster Table.
Clusters 1-4 were identified using a thresholding of $p = 0.01$, minimum cluster size = 81 voxels.

Cluster/subcluster	Cluster Size	Peak Coordinates (x,y,z)	T-value	Anatomical Location
1	277	-16.5, 85.5, -6.5	5.250	Right Lingual Gyrus, Middle Occipital Gyrus
2	227	13.5, -49.5, 29.5	-5.012	Left Superior Frontal Gyrus
3	206	-46.5, 37.5, 38.5	4.714	Right Inferior Parietal Lobule, Supramarginal Gyrus
4	87	4.5, 49.5, 17.5	-4.194	Bilateral Posterior Cingulate

Supplementary Figure 3. This figure shows the results from the whole-brain voxel-level analysis on the activity averaged across the -4.8 to 0.0sec window prior to target onset. This map shows the T-statistic thresholded after correction for multiple comparisons (Monte-Carlo $p < 0.05$, cluster size > 353 voxels). This is the same data as Figure 5b in the main text but shown using axial slices on AfNI's TTN27 template in neurological space (Left=Left) in order to aid visualization of voxels in subcortical and cerebellar regions.



Supplementary Figure 4. This figure shows the a priori ROIs for the Parahippocampal Place Area (PPA: red regions), the Dorsal Attention Network (DAN; green regions), and the Default Mode Network (DMN; orange regions). These ROIs were derived in Esterman et al. (2013). Note a total of 10 Nodes are found across the three ROIs.