

Supplementary report

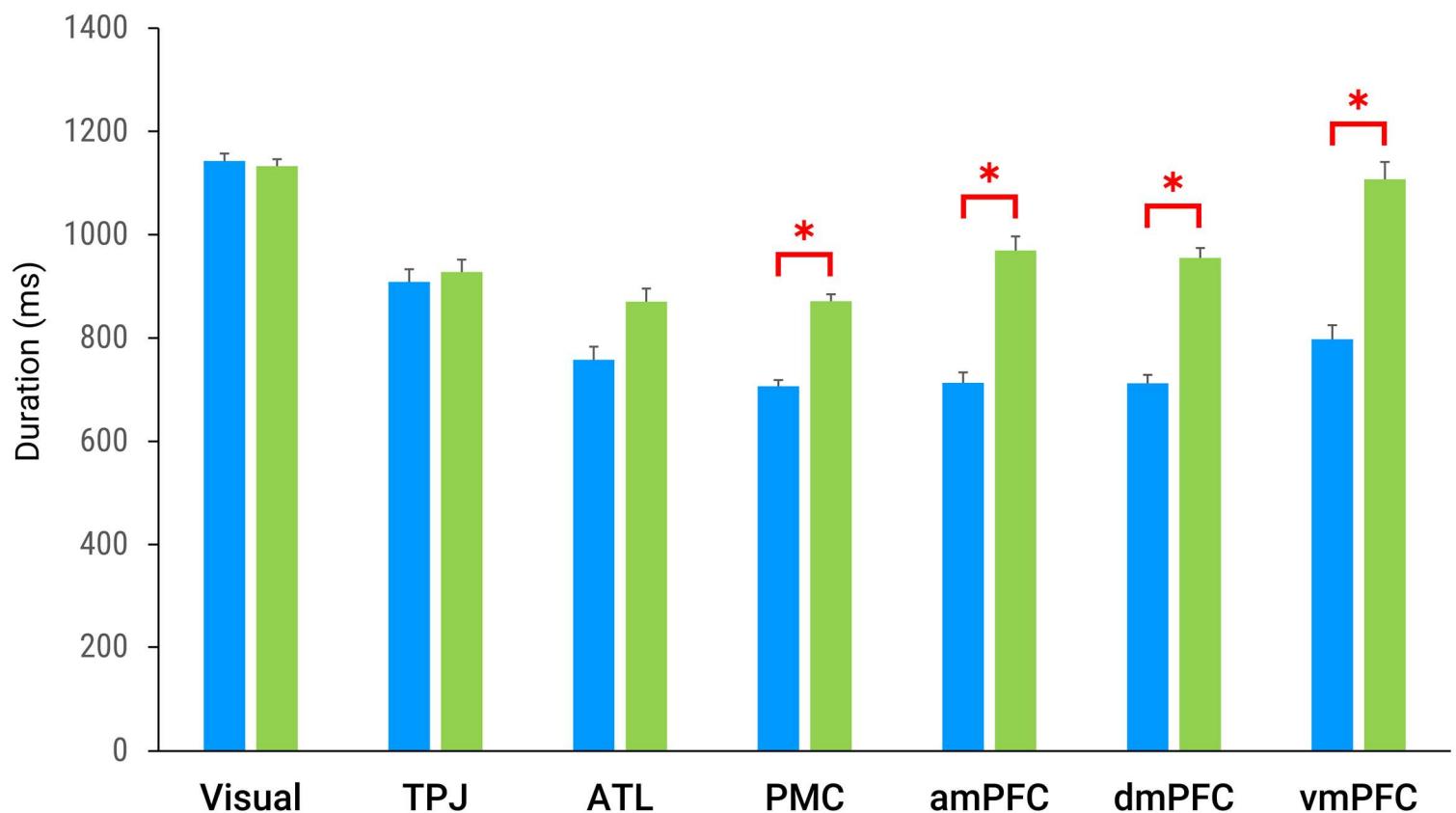
To complement our analyses of onset, peak, and offset latencies (see Fig. 1E and Main Results), we examined single-trial metrics of response duration using analogous methods as the aforementioned latency metrics (see Main Methods). Single-trial analysis (Fig. 1e) was used to identify timepoints within individual trials that featured significant stimulus-evoked responses (brown areas; $p_{\text{FDR}} < .05$, corrected for number of timepoints, trials, and sites) relative to the pre-stimulus baseline preceding each trial (see Main Methods). The number of timepoints with significant activations and deactivations (i.e., higher or lower HFB power, respectively, relative to the pre-stimulus baseline) was used to calculate single-trial metrics of activation duration and deactivation duration, respectively. Timepoints after behavioral response times (RT_{task}) were discarded.

To compare activation durations evoked by self- and other-mentalizing across regions-of-interests (ROIs), we examined single-trial metrics of activation duration from ROI sites using the same inclusion criteria and linear mixed-effect model (LMM) specifications as ROI analyses of onsets, peaks, and offsets (see Main Methods). These LMM specifications identified variance unique to Condition (other-self) and RT_{task} while accounting for heterogeneity across subjects and sites (Supplementary Table 1). Next, we examined whether self/other differences and RT_{task} associations became stronger or weaker in ROIs with later activations. To this end, we correlated Condition and RT_{task} effect sizes (b -coefficients in Supplementary Table 1) with mean onset latencies (black squares in Fig. 3f) across all seven ROIs.

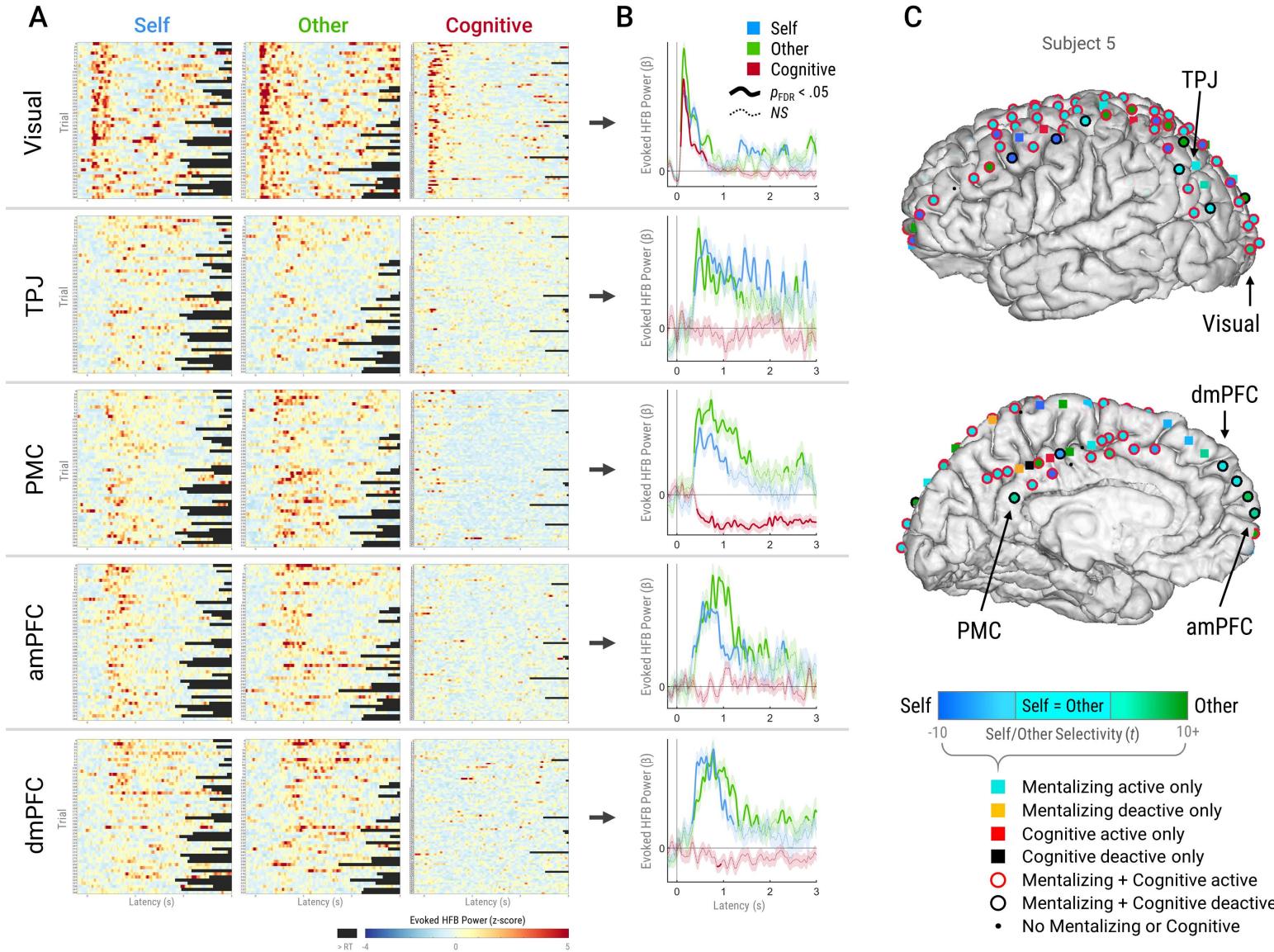
We found that other-mentalizing evoked significantly ($p < .05$) longer activations than self-mentalizing in posteromedial cortex (PMC), anteromedial prefrontal cortex (amPFC), dorsomedial prefrontal cortex (dmPFC), and ventromedial prefrontal cortex (vmPFC; Supplementary Fig. 1). Non-significant self/other differences were found in visual cortex, temporoparietal junction (TPJ), and anterior temporal lobe (ATL). Moreover, we found that

self/other differences became stronger in ROIs with later activations; $r(5) = .96, p = .0008$ (Supplementary Table 1). LMEMs also revealed that all ROIs significantly predicted RT_{task} in the positive direction (Supplementary Table 1). Unexpectedly, we found that RT_{task} effects became weaker in ROIs with later activations; $r(5) = -.81, p = .028$.

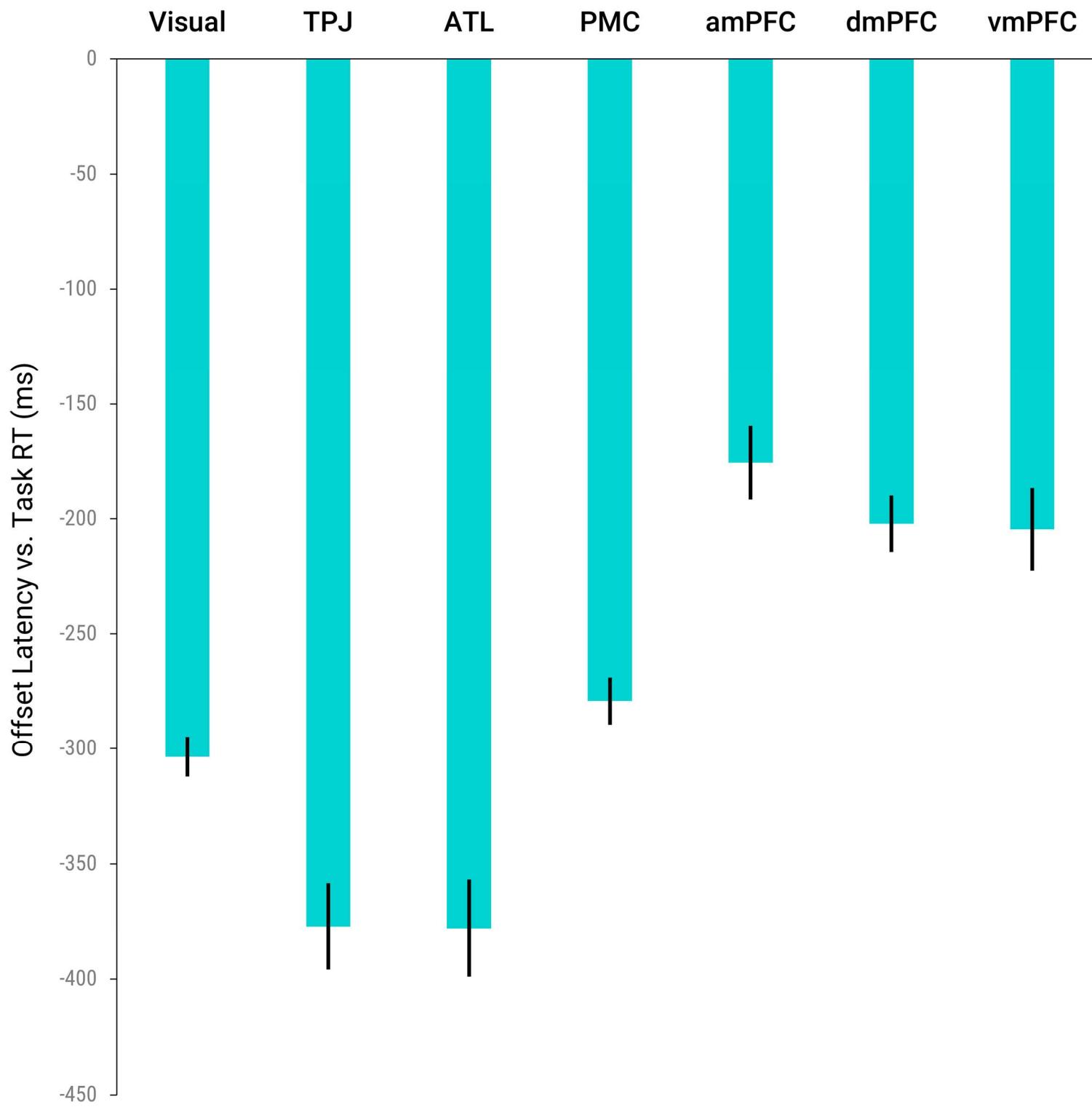
Supplementary Figure S1. Mean activation duration across mentalizing type and ROI. Error bars indicate standard error. Asterisks indicate significant ($p < .05$) self/other differences after accounting for behavioral response times and other confounds (see Supplementary Table 1). Abbreviations: Visual = visual cortex; ATL = anterior temporal lobe; TPJ = temporoparietal junction; PMC = posteromedial cortex; amPFC = anteromedial prefrontal cortex; dmPFC = dorsomedial prefrontal cortex; vmPFC = ventromedial prefrontal cortex; ms = millisecond.



Supplementary Figure S2. Single-subject results from exemplar ROI sites in Subject 5, which are indicated by arrows in Panel C. **A)** Heatmaps of HFB power (z-scored) within each timepoint and trial. Black areas indicate timepoints discarded after RT_{Task} . **B)** Timecourses of mean HFB responses (β) estimated by LMEMs using the data in Panel A. Thick solid lines indicate significant responses relative to the pre-stimulus baseline ($p_{FDR} < .05$), while thin dotted lines indicate non-significant responses. **C)** Single-site results from Subject 5 overlaid on their native cortical surface. Activation refers to HFB responses significantly higher than baseline, while deactivation refers to responses significantly lower than baseline. Mentalizing-active sites are colored by the t-score of self/other differences in HFB peak power. **Abbreviations:** HFB = high-frequency broadband; LMEM = linear mixed-effects model; s = seconds; β = standardized LMEM coefficient; p_{FDR} = p-value adjusted for False Discovery Rate; NS = not significant ($p_{FDR} > .05$)

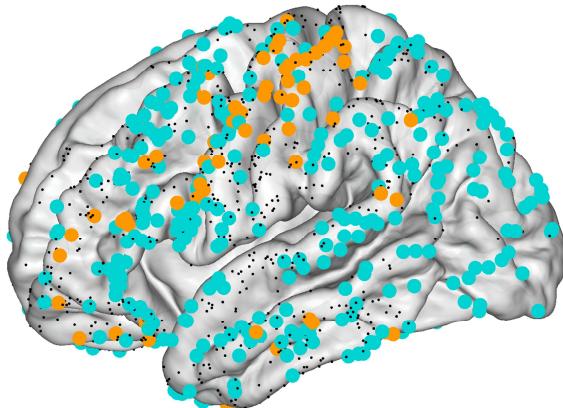


Supplementary Figure S3. Mean difference between HFB offsets and behavioral response times (RT_{Task}) during mentalizing (collapsed across self and other). Error bars indicate standard error of the mean.

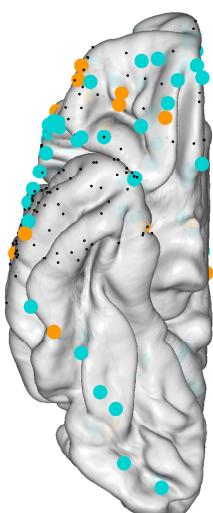
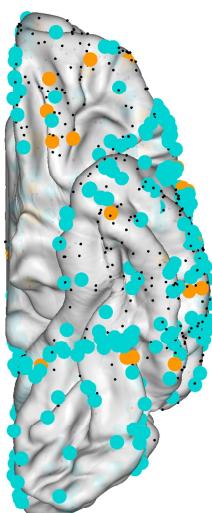
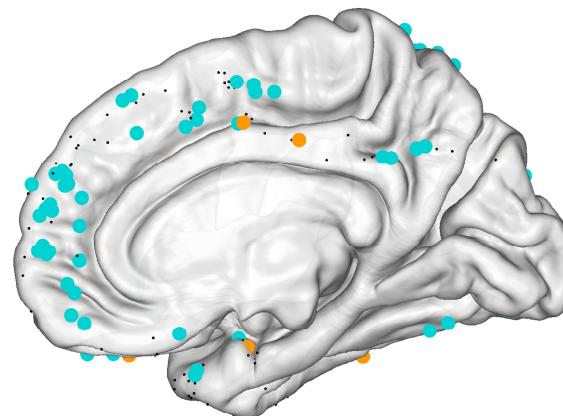
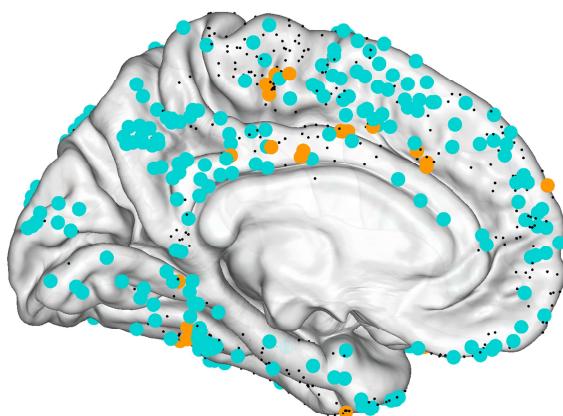
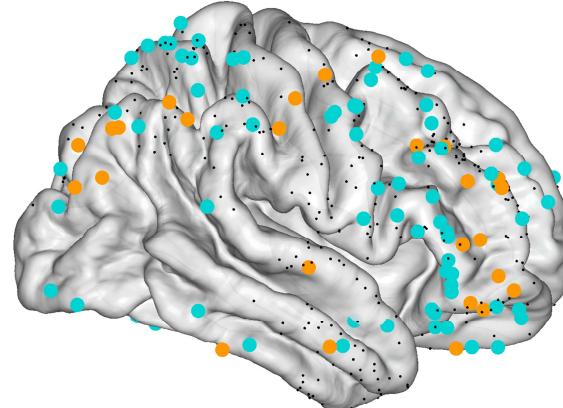


Supplementary Figure S4: expanded lateralized views of Figure 3a. MNI map of sites identified as active, deactive, or nonresponsive for mentalizing via trial-averaged analysis ($p_{\text{FDR}} < .05$; corrected for number of timepoints and sites)

L



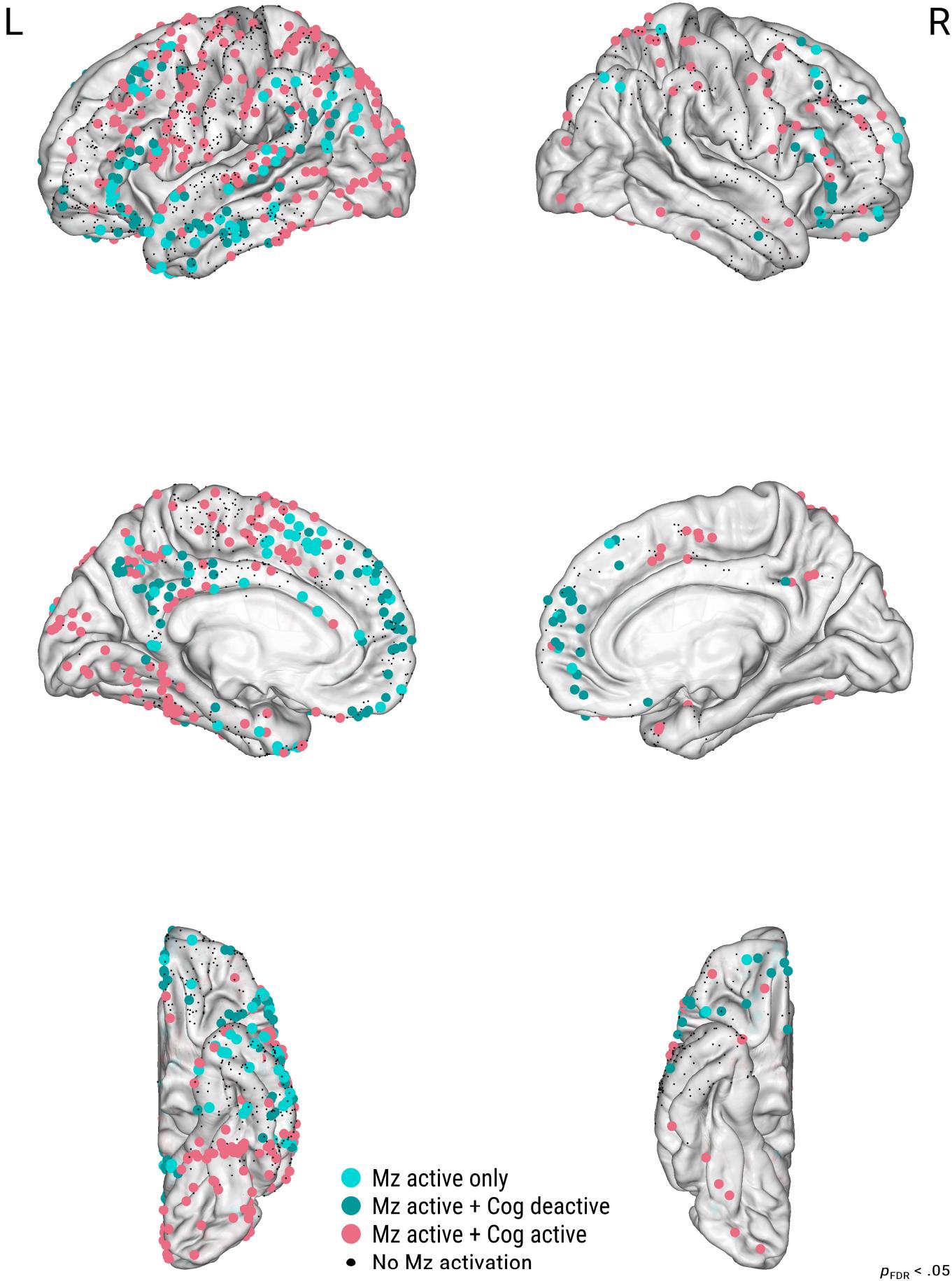
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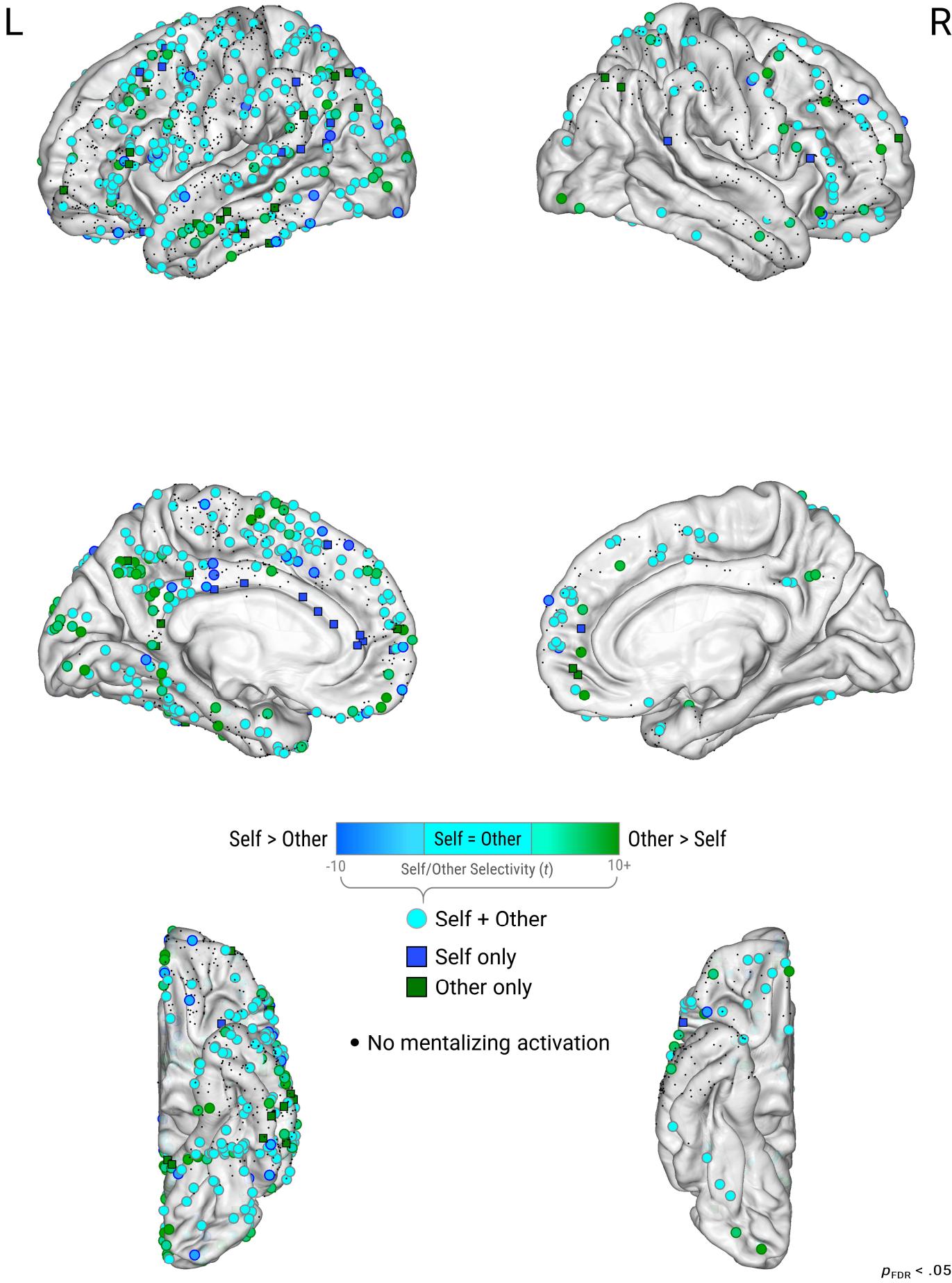
- Mz active
- Mz deactive
- Mz nonresponsive

$p_{\text{FDR}} < .05$

Supplementary Figure S5: expanded lateralize views of Figure 3C. Functional specificity of mentalizing-active sites as identified by trial-averaged analysis ($p_{\text{FDR}} < .05$; corrected for number of timepoints and sites). Sites were considered 'mentalizing-specific' (light and dark turquoise) if they were mentalizing-active but not cognitive-active. Sites were reconsidered 'non-specific' (pink) if they coactivated for mentalizing and the cognitive task.

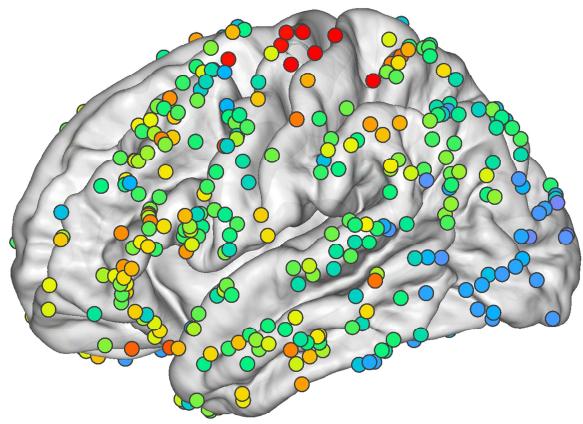


Supplementary Figure S6: expanded lateralized views of Figure 4A. Functional anatomy of self- and other-mentalizing. Circles indicate sites with significant HFB activations for both self- and other-mentalizing, colored by the t-score of self/other differences in HFB peak power ($p_{\text{FDR}} < .05$; corrected for number of sites). Squares indicate sites with significant activations for only one mentalizing type. Dots indicate sites with nonsignificant mentalizing activations

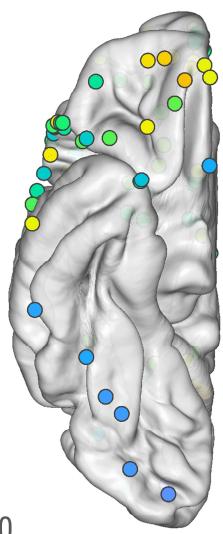
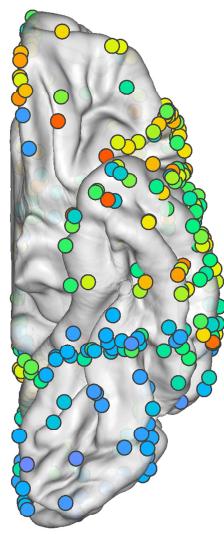
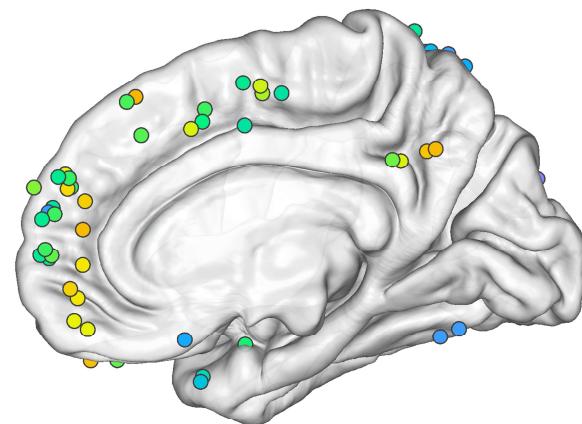
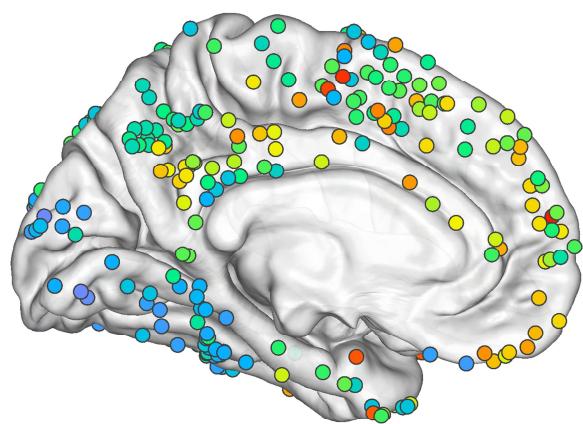
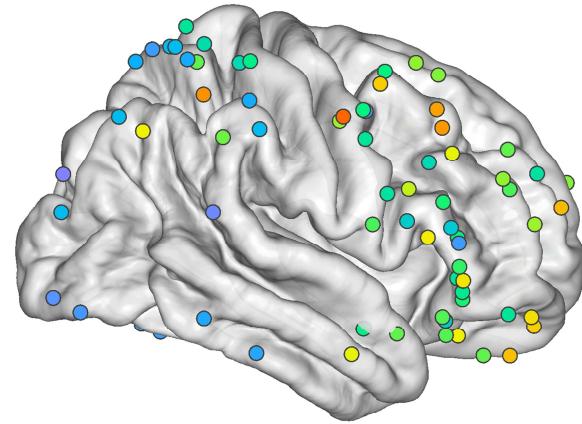


Supplementary Figure S7: expanded lateralized views of Figure 5A. Mean mentalizing HFB onset latencies of mentalizing-active sites using single-trial analysis (see Figure 1E).

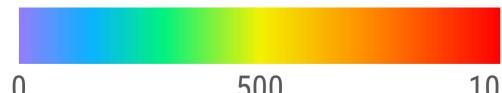
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R



Mentalizing Onset Latency (ms)



0

500

1000

$p_{\text{FDR}} < .05$

Supplementary Table 1. ROI analysis of activation duration

Omnibus	Duration (ms)		
	<i>F</i>	<i>DF_{1/2}</i>	<i>p</i>
ROI	2.005	6/25	0.102
Cond (Other-Self)	31.29	1/14	<.001
RT _{Task}	292.6	1/16	<.001
ROI x Cond	1.320	6/108	0.255
ROI x RT _{Task}	4.849	6/15	0.006
Cond x RT _{Task}	1.662	1/59	0.202
ROI x Cond x RT _{Task}	2.344	6/35	0.052
Cond in ROI	<i>b</i>	<i>SE</i>	<i>p</i>
Visual Other - Self	-23	15	0.111
TPJ Other - Self	21	31	0.487
ATL Other - Self	48	31	0.119
PMC Other - Self	101	18	<.001
amPFC Other - Self	146	31	<.001
dmPFC Other - Self	148	24	<.001
vmPFC Other - Self	196	43	<.001
RT in ROI	<i>b</i>	<i>SE</i>	<i>P</i>
Visual	0.342	0.026	<.001
TPJ	0.295	0.043	<.001
ATL	0.221	0.028	<.001
PMC	0.249	0.013	<.001
amPFC	0.212	0.025	<.001
dmPFC	0.280	0.022	<.001
vmPFC	0.198	0.030	<.001

Supplemental Table 2: Subject demographics and characteristics.

	Age	Sex	IQ	Handedness	ECoG Hemisphere	Epilepsy Duration	Epileptic Foci
S1	62	F	n/a	R	L	49 years	Orbitofrontal, Medial Temporal
S2	40	M	88	R	L	23 years	Lateral Frontal, Medial Temporal
S3	24	F	101	R	R	4 years	Ventral Temporal
S4	36	F	n/a	R	L	9 years	Primary Motor
S5	22	F	n/a	R	L	1 year	Medial Frontal
S6	51	F	101	L	L	8 years	Medial Temporal
S7	46	M	n/a	L & R	R	16 years	Primary Motor
S8	31	F	71	R	L	18 years	Orbitofrontal
S9	52	F	112	R	L	36 years	Lateral Parietal
S10	28	M	77	R	L	12 years	Anterior Temporal
S11	33	M	119	R	R	22 years	Frontopolar
S12	23	F	93	R	R	15 years	Lateral Frontal
S13	38	F	93	L & R	L	13 years	Primary Motor
S14	44	M	n/a	R	L	9 years	Lateral Frontal, Medial Temporal
S15	22	M	100	R	L	5 years	Lateral Temporal
S16	48	F	81	R	L	1 year	Lateral Temporal

Supplemental Table 3: Summary statistics of ROI and HFB metrics. *N*-values refer to the number of subjects with coverage in an ROI. L- and R-values refer to number of sites in the left and right hemispheres, respectively. The *n*-values refer to the number of sites with significant ($p_{\text{FDR}} < .05$) HFB responses. **Abbreviations:** ms = millisecond; \bar{x} = sample mean; *SE* = standard error; ROI = region of interest; visual = visual cortex; ATL = anterior temporal lobe; TPJ = temporoparietal junction; PMC = posteromedial cortex; amPFC = anteromedial prefrontal cortex; dmPFC = dorsomedial prefrontal cortex; vmPFC = ventromedial prefrontal cortex

ROI	N	L	R	Condition	<i>n</i>	Latency (ms)				Power (z)		Duration (ms)			
						Onset		Peak		Offset		Peak	Peak	M	SE
Visual	14	95	7	Self	70	96	2	736	13	2032	22	2.776	0.041	1143	14
				Other	70	92	2	708	12	2046	21	3.117	0.046	1133	13
				Cognitive	73	93	2	928	10	2528	15	1.788	0.011	1218	11
TPJ	14	76	19	Self	28	324	9	1074	28	1907	38	1.974	0.022	909	24
				Other	28	308	9	1008	26	1908	38	1.991	0.021	928	24
				Cognitive	32	289	9	1341	32	2699	43	1.004	0.021	1230	25
ATL	12	74	38	Self	24	341	11	1063	32	1808	46	1.608	0.025	758	25
				Other	24	367	12	1152	34	2057	45	1.709	0.027	870	25
				Cognitive	14	328	29	1487	41	2634	48	1.476	0.024	964	22
PMC	10	66	9	Self	44	345	8	902	14	2038	29	2.026	0.025	706	12
				Other	48	360	7	1020	15	2266	28	2.398	0.037	871	14
				Cognitive	49	299	8	1651	31	3129	33	0.941	0.020	1653	28
amPFC	11	36	13	Self	18	476	17	1260	33	2147	51	1.835	0.033	713	20
				Other	15	496	18	1406	34	2378	49	1.999	0.034	970	27
				Cognitive	18	328	11	2016	39	3575	38	-0.888	0.011	1522	34
dmPFC	10	54	27	Self	28	488	12	1236	23	2162	36	1.875	0.019	712	16
				Other	28	528	14	1516	27	2427	36	1.883	0.019	955	19
				Cognitive	28	347	9	1881	27	3311	29	-0.878	0.008	1406	24
vmPFC	11	33	8	Self	10	568	25	1412	37	2284	50	1.829	0.027	798	27
				Other	11	626	22	1695	37	2745	46	2.169	0.031	1107	34
				Cognitive	12	365	12	1762	39	3103	42	-0.904	0.013	1269	33

Supplemental Table 4: Lateralized summary statistics for mentalizing-evoked HFB activations (collapsed across self and other). n = number of mentalizing-active sites.

ROI	L/R	n	Latency (ms)						Power (z-score)		
			Onset		Peak		Offset		Peak		
			M	SE	M	SE	M	SE	M	SE	
Visual	L	65	96	2	718	9	2170	16	2.969	0.033	
	R	5	86	5	781	40	1699	53	2.635	0.066	
TPJ	L	31	323	6	1033	19	2005	26	2.046	0.016	
	R	3	234	30	1337	121	2405	155	1.778	0.050	
ATL	L	22	368	9	1137	25	2248	35	1.810	0.023	
	R	2	288	24	759	59	1301	78	1.578	0.047	
PMC	L	44	362	6	941	11	2139	21	1.959	0.014	
	R	4	423	23	1243	39	2395	70	1.608	0.027	
amPFC	L	11	557	20	1682	39	2991	50	1.808	0.019	
	R	9	425	15	1019	22	1638	38	1.970	0.025	
dmPFC	L	16	496	13	1489	27	2595	36	2.033	0.020	
	R	12	491	13	1267	23	1984	35	1.721	0.016	
vmPFC	L	7	657	24	1745	35	2652	41	1.921	0.026	
	R	4	517	22	1347	38	2396	57	2.133	0.035	