

## Supplementary Materials

A full list of region abbreviations and their corresponding definitions is provided in Supplementary Table I.

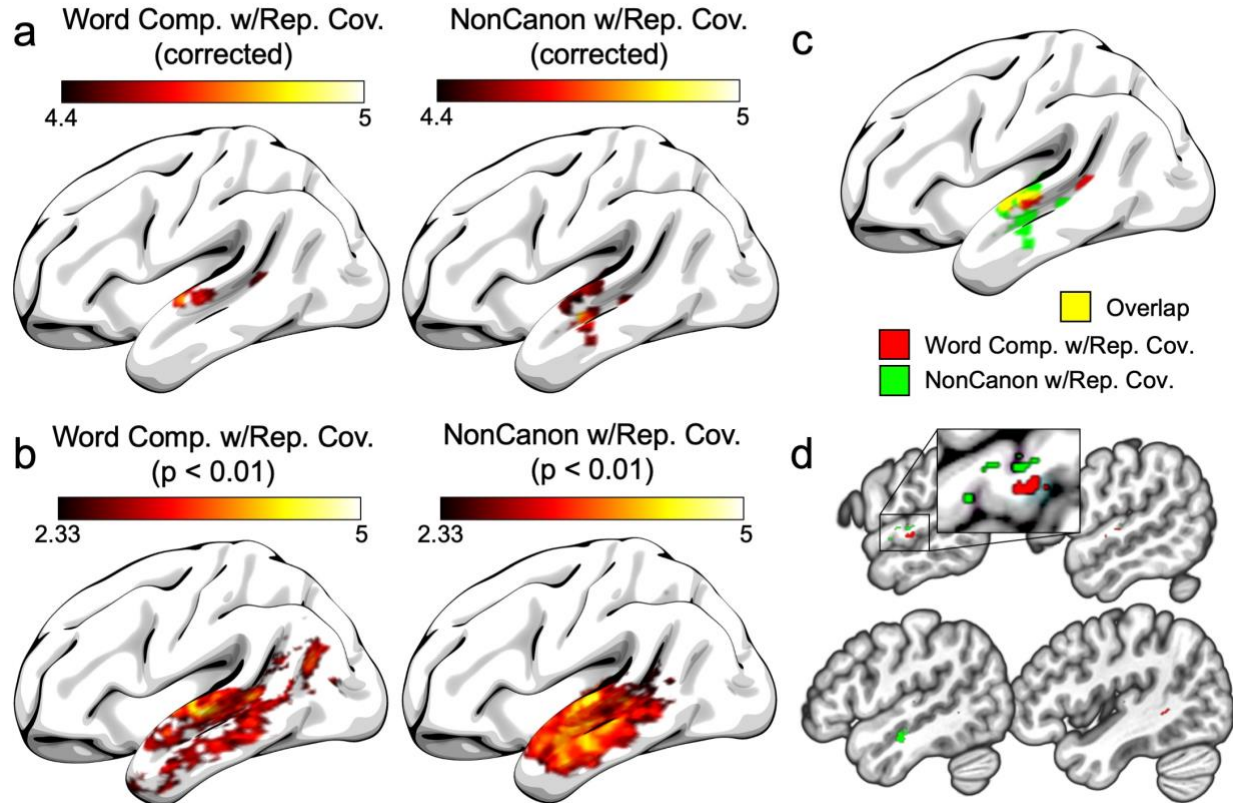
**Supplementary Table I Full list of region abbreviation definitions**

<i>Region Abbreviation</i>	<i>Definition/full region name</i>
aCR	Anterior corona radiata
AG	Angular gyrus
Amygdala	Amygdala
Caudate	Caudate nucleus
CP	Cerebral peduncle
CR	Corona radiata (middle/superior portion)
Cuneus	Cuneus
FuG	Fusiform gyrus
GP	Globus pallidus
Hippocampus	Hippocampus
IFG opercularis	Inferior frontal gyrus, pars opercularis
IFG orbitalis	Inferior frontal gyrus, pars orbitalis
IFG triangularis	Inferior frontal gyrus, pars triangularis
IOG	Inferior occipital gyrus
ITG	Inferior temporal gyrus
LFOG	Lateral fronto-orbital gyrus
LG	Lingual gyrus
MFG	Middle frontal gyrus (middle portion)
MFOG	Middle fronto-orbital gyrus
Midbrain	Midbrain
MOG	Middle occipital gyrus
MTG	Middle temporal gyrus (middle portion)
MTG pole	Pole of middle temporal gyrus
PCC	Posterior cingulate gyrus
pCR	Posterior corona radiata
pInsula	Posterior insula
pITG	Posterior inferior temporal gyrus
pMFG	Posterior middle frontal gyrus
pMTG	Posterior middle temporal gyrus
PoCG	Postcentral gyrus
PrCG	Precentral gyrus
Precuneus	Precuneus
pSFG	Posterior superior frontal gyrus
pSTG	Posterior superior temporal gyrus
Putamen	Putamen
RedNc	Red nucleus
SFG	Superior frontal gyrus
SLF/AF	Superior longitudinal fasciculus/arcuate fasciculus
SMG	Supramarginal gyrus
Snigra	Substantia nigra
SOG	Superior occipital gyrus
SPL	Superior parietal lobule/superior parietal gyrus
STG	Superior temporal gyrus (middle portion)
STG pole	Pole of superior temporal gyrus
Thalamus	Thalamus

Figures 1 and 2 from the main body of the manuscript describe LSM analyses including our two primary measures of interest, Word Comprehension (WAB-R Auditory Word Recognition with Pyramids and Palm Trees, PPT, as a covariate) and Noncanonical Sentence Comprehension. Here we report supplementary analyses of these measures including an additional covariate, Repetition (WAB-R Repetition score), in an attempt to control for

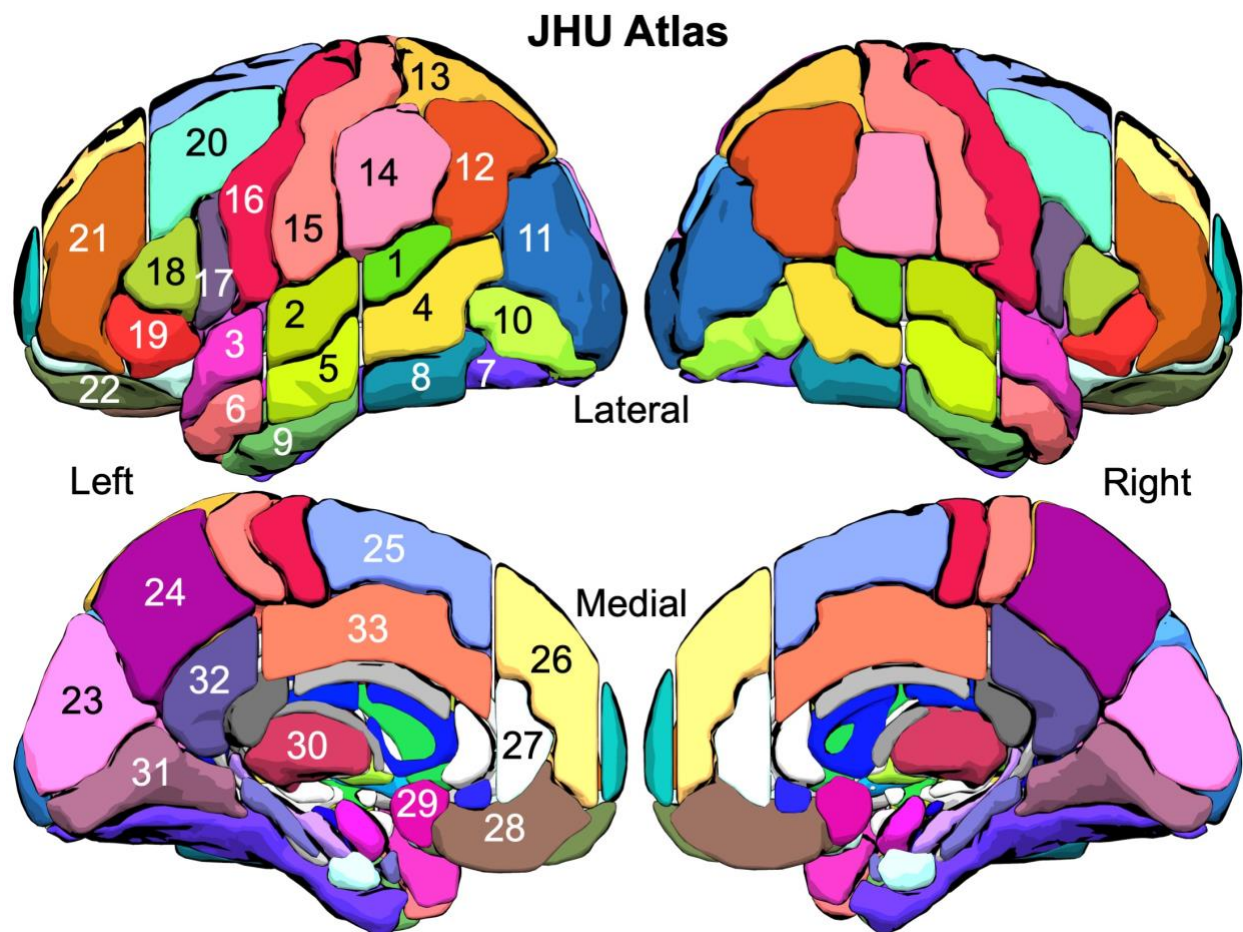
phonological processing and focus on lexical and syntactic levels of representation. The results are shown in Supplementary Figure 1.

## Supplementary LSM Analyses



Supplementary Figure 1. Supplementary voxel-based lesion-symptom mapping (LSM) results for Word Comprehension (WAB-R Auditory Word Recognition with the PPT covariate) and Noncanonical Sentence Comprehension incorporating Repetition scores as a covariate. a) Analyses with a permutation correction for multiple comparisons (10,000 permutations, corrected  $p < 0.05$ ), with results spatially smoothed for improved visibility. b) Unsmoothed analyses using an uncorrected voxel-wise threshold of  $p < 0.01$  (one-tailed). c) Smoothed surface rendering of the overlap (yellow) of the corrected lesion maps for Word Comprehension (red) and Noncanonical Sentence Comprehension (green). d) Unsmoothed slices of the volumetric (non-surface-rendered) overlap. Inset shows a zoomed-in view of the portion of the slice surrounded by the rectangle.

Supplementary Figure 2 provides an illustration of the JHU atlas for some (but not all) relevant regions for the LSM and CLSM analyses reported in the manuscript.



Supplementary Figure 2. Illustration of the JHU atlas. See Supplementary Table 1 for region abbreviation definitions. Numbers illustrate some (but not all) of the relevant regions contained within the atlas. (1): pSTG; (2): STG; (3): STG pole; (4): pMTG; (5): MTG; (6): MTG pole; (7) FuG; (8) pITG; (9) ITG; (10) IOG; (11) MOG; (12) AG; (13) SPL; (14) SMG; (15) PoCG; (16) PrCG; (17) IFG opercularis; (18) IFG triangularis; (19) IFG orbitalis; (20) pMFG; (21) MFG; (22) MFOG; (23) Cuneus; (24) Precuneus; (25) pSFG; (26) SFG; (27) aCR; (28) GR; (29) SaCG; (30) Thalamus; (31) LG; (32) pCR; (33) CR.

The statistical details of the combined LSM-CLSM analyses described in section 2.3.4, with the results summarized in section 3.4, are provided in Supplementary Table 2. The analysis of Word Comprehension (WAB-R Auditory Word Recognition with PPT covariate) assessed the contribution of lesion volume in the four middle and posterior temporal lobe regions identified in our ROI-based LSM analyses, controlling for the strongest disconnection identified in the CLSM analyses involving a more anterior temporal lobe region as well as total lesion volume. For the STG/MTG, this was the MTG pole ↔ SOG, and for the pSTG/pMTG this was the MTG ↔ SOG. The analysis of Noncanonical (Noncanonical sentence comprehension) assessed the contribution of lesion volume in all of the four middle and posterior temporal lobe regions identified in our ROI-based LSM analyses, controlling for the strongest sub-threshold connection involving a subregion of the IFG or MFG identified in the CLSM analyses, the IFG orbitalis ↔ Cuneus, as well as total lesion volume.

Supplementary Table 2 Combined LSM-CLSM analyses

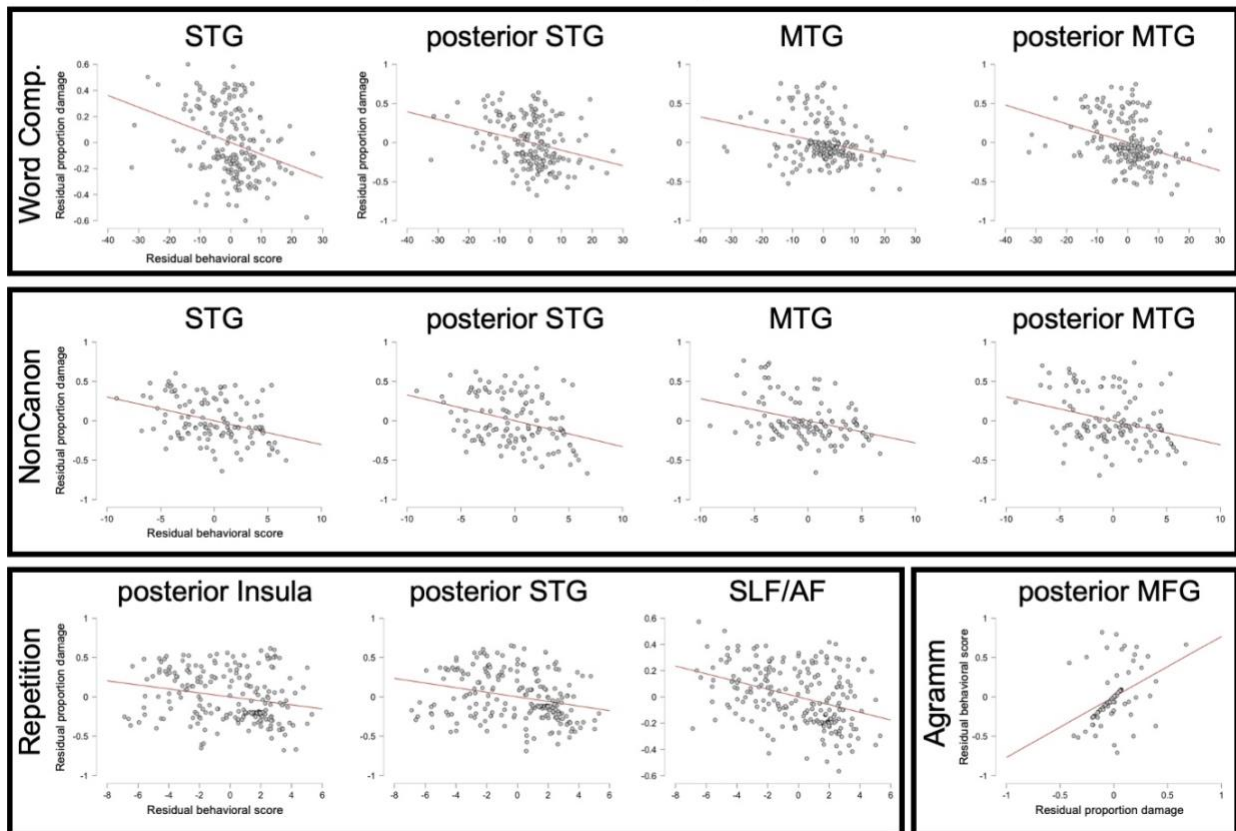
Analysis	R <sup>2</sup>	β <sub>u</sub> (SE)	β <sub>s</sub>	Z	BF <sub>m</sub> (null)
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<b>Word Comprehension</b>					
pSTG, controlling for MTG ↔ SOG	0.218	-7.190 (2.306)	-0.310	3.09	7.416e-7
pMTG, controlling for MTG ↔ SOG	0.239	-8.722 (2.301)	-0.347	3.71	8.707e-8
STG, controlling for MTG pole ↔ SOG	0.223	-8.186 (2.575)	-0.317	3.09	5.686e-7
MTG, controlling for MTG pole ↔ SOG	0.202	-6.061 (2.526)	-0.213	2.37	8.392e-6
<b>Noncanonical</b>					
pSTG, controlling for IFG orbitalis ↔ Cuneus	0.242	-3.361 (0.914)	-0.389	3.57	1.308e-5
pMTG, controlling for IFG orbitalis ↔ Cuneus	0.230	-3.112 (0.925)	-0.330	3.29	3.872e-5
STG, controlling for IFG orbitalis ↔ Cuneus	0.261	-4.330 (1.052)	-0.464	3.98	2.085e-6
MTG, controlling for IFG orbitalis ↔ Cuneus	0.248	-4.044 (1.059)	-0.374	3.70	8.117e-6

See Supplementary Table 1 for region abbreviation definitions. All regions are left hemisphere.  $\beta_u$  = unstandardized estimated beta coefficient, SE = standard error,  $\beta_s$  = standardized estimated beta coefficient, Z = Z-score,  $BF_m$  (null) = Bayes Factor index indicating support for the null hypothesis.

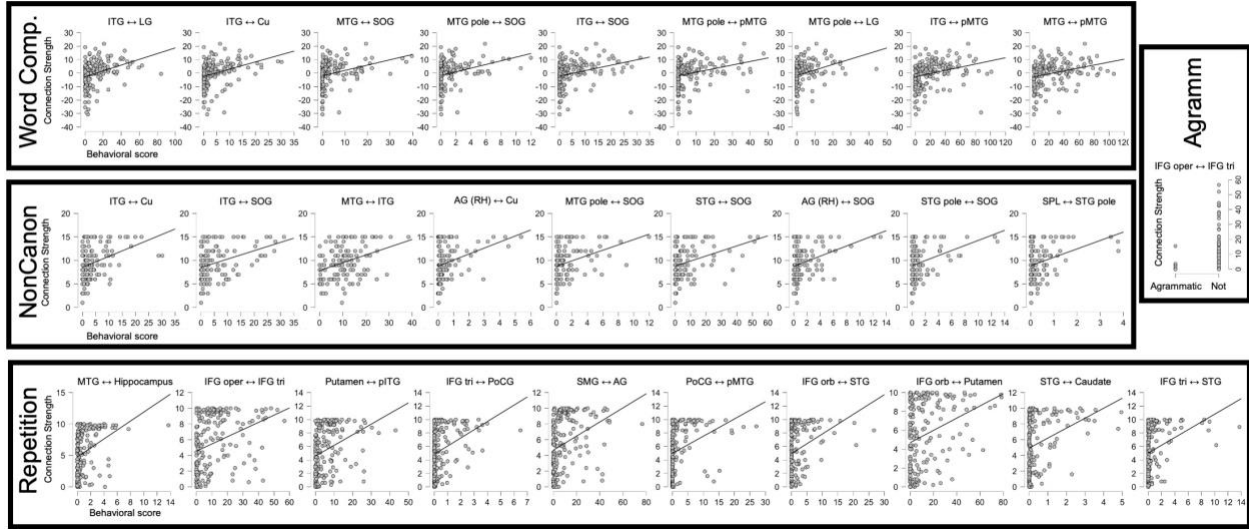
In order to illustrate the goodness of linear fits to our ROI-based LSM and CLSM data, Supplementary Figures 3 and 4 report scatterplots of the individual subject data used in these analyses.

### LSM Scatterplots



Supplementary Figure 3. Scatterplots of the ROI-based LSM analyses for each behavioral measure, reflecting residual values after the effect of lesion volume is regressed out. Lines indicate linear trend. See Supplementary Table 1 for region abbreviation definitions. Comp = Comprehension; NonCanon = Noncanonical Sentence Comprehension; Agramm = Expressive Agrammatism.

# CLSM Scatterplots



Supplementary Figure 4. Scatterplots of the top ten significant disconnections from the CLSM analyses for each behavioral measure. Lines indicate linear trend. See Supplementary Table 1 for region abbreviation definitions. Comp = Comprehension; NonCanon = Noncanonical Sentence Comprehension; Agramm = Expressive Agrammatism.

In Table 4, we reported the top ten significant connections between regions from the JHU atlas (Faria et al., 2012) to which damage was associated with each of the four primary behavioral measures in our connectome lesion-symptom mapping (CLSM) analyses. Supplementary Table 3 lists the entire set of significant connections, as well as the significant connections for the two supplemental behavioral measures, WAB-R Word Comprehension with PPT and WAB-R Repetition Covariates and Noncanonical Sentence Comprehension with WAB-R Repetition Covariate.

Supplementary Table 3. Full list of significant connections in CLSM analyses.

Connection	R <sup>2</sup>	β <sub>u</sub> (SE)	β <sub>s</sub>	Z	BF <sub>m</sub> (null)
<b>WAB-R repetition</b>					
MTG ↔ Hippocampus	0.125	0.713 (0.135)	0.353	5.10	0.00003
IFG opercularis ↔ IFG triangularis	0.119	1.296 (0.252)	0.345	4.97	0.00005
IFG opercularis ↔ PrCG	0.117	0.742 (0.146)	0.342	4.94	0.00006
Putamen ↔ pITG	0.116	1.215 (0.239)	0.341	4.92	0.00006
SMG ↔ AG	0.115	1.278 (0.253)	0.339	4.89	0.00007
PoCG ↔ pMTG	0.107	0.419 (0.086)	0.328	4.71	0.0002
IFG orbitalis ↔ STG	0.107	0.367 (0.076)	0.327	4.71	0.0002
IFG orbitalis ↔ Putamen	0.107	0.065 (0.013)	0.327	4.70	0.0002
STG ↔ Caudate	0.106	1.268 (0.262)	0.326	4.69	0.0002
IFG triangularis ↔ STG	0.106	0.184 (0.038)	0.326	4.68	0.0002
PCC (RH) ↔ GP	0.102	1.979 (0.420)	0.319	4.58	0.0003
MTG ↔ ITG	0.102	0.662 (0.141)	0.319	4.58	0.0003
MTG ↔ Thalamus	0.101	0.432 (0.092)	0.318	4.57	0.0003
PrCG ↔ pSTG	0.098	0.363 (0.078)	0.314	4.50	0.0004
SOG ↔ GP	0.098	0.704 (0.153)	0.313	4.49	0.0004
MTG ↔ Putamen	0.097	0.225 (0.049)	0.311	4.46	0.0005
IFG orbitalis ↔ Amygdala	0.096	19.288 (4.237)	0.309	4.43	0.0006
IFG triangularis ↔ PoCG	0.095	0.192 (0.042)	0.309	4.42	0.0006
PCC (RH) ↔ Putamen	0.095	0.960 (0.212)	0.308	4.41	0.0006
STG ↔ Hippocampus	0.093	1.307 (0.291)	0.306	4.38	0.0007
PoCG ↔ AG	0.092	0.758 (0.170)	0.304	4.35	0.0008
SPL ↔ GP	0.092	0.486 (0.109)	0.304	4.35	0.0008

SPL ↔ Putamen	0.092	0.200 (0.045)	0.303	4.34	0.0008
IFG triangularis ↔ SOG	0.091	0.072 (0.016)	0.302	4.32	0.0009
IFG triangularis ↔ pInsula	0.091	0.319 (0.072)	0.301	4.31	0.001
IFG triangularis ↔ Cuneus	0.090	0.037 (0.008)	0.301	4.30	0.001
STG pole ↔ CP (RH)	0.090	14.430 (3.283)	0.300	4.29	0.001
IFG opercularis ↔ Amygdala	0.089	33.199 (7.588)	0.298	4.27	0.001
MOG ↔ GP	0.089	0.906 (0.207)	0.298	4.27	0.001
SOG ↔ Caudate	0.089	9.195 (2.104)	0.298	4.26	0.001
IFG triangularis ↔ LG	0.088	0.071 (0.016)	0.297	4.25	0.001
STG pole ↔ Hippocampus	0.088	1.165 (0.269)	0.296	4.23	0.001
MTG pole ↔ Hippocampus	0.087	0.456 (0.105)	0.295	4.22	0.001
STG pole ↔ RedNc	0.087	25.646 (5.942)	0.295	4.21	0.001
IFG triangularis ↔ Amygdala	0.087	22.208 (5.151)	0.294	4.21	0.001
PoCG (RH) ↔ STG pole	0.086	28.570 (6.638)	0.294	4.20	0.001
IFG orbitalis ↔ LG	0.085	0.216 (0.050)	0.292	4.18	0.002
IFG opercularis ↔ PoCG	0.085	0.222 (0.052)	0.291	4.17	0.002
RedNc ↔ pITG	0.084	28.520 (6.717)	0.290	4.15	0.002
STG ↔ SOG	0.084	0.808 (0.191)	0.289	4.13	0.002
STG ↔ Putamen	0.083	0.197 (0.047)	0.288	4.12	0.002
IFG triangularis ↔ PrCG	0.083	0.372 (0.088)	0.288	4.11	0.002
MTG pole ↔ Caudate	0.083	0.992 (0.236)	0.288	4.11	0.002
IFG orbitalis ↔ MTG	0.082	0.208 (0.050)	0.285	4.08	0.002
PrCG (RH) ↔ STG pole	0.081	34.734 (8.383)	0.284	4.05	0.003
MTG ↔ Caudate	0.080	0.836 (0.202)	0.283	4.04	0.003
IFG orbitalis ↔ FuG	0.080	0.123 (0.030)	0.283	4.04	0.003
LFOG ↔ Hippocampus	0.080	2.923 (0.710)	0.282	4.02	0.003
PrCG ↔ SMG	0.079	0.796 (0.195)	0.280	4.00	0.003
IFG triangularis ↔ Putamen	0.078	0.090 (0.022)	0.279	3.98	0.003
SPL ↔ pMTG	0.078	0.764 (0.188)	0.279	3.98	0.004
IFG orbitalis ↔ SOG	0.078	0.118 (0.029)	0.279	3.97	0.004
PoCG ↔ SMG	0.077	1.108 (0.274)	0.277	3.95	0.004
SPL ↔ pSTG	0.077	0.898 (0.223)	0.277	3.95	0.004
Snigra ↔ pITG	0.076	26.114 (6.485)	0.276	3.94	0.004
PrCG ↔ pMTG	0.076	0.861 (0.214)	0.276	3.94	0.004
SPL ↔ STG pole	0.076	0.046 (0.011)	0.276	3.93	0.004
STG (RH) ↔ STG pole	0.076	0.011 (0.003)	0.276	3.93	0.004
Midbrain ↔ pITG	0.076	2.947 (0.735)	0.275	3.93	0.004
SPL (RH) ↔ Putamen	0.076	1.135 (0.283)	0.275	3.92	0.004
AG ↔ Putamen	0.075	0.508 (0.127)	0.275	3.92	0.004
STG ↔ PCC	0.075	0.166 (0.042)	0.274	3.90	0.005
GP ↔ pSTG (RH)	0.075	3.310 (0.832)	0.273	3.90	0.005
MFG ↔ Amygdala	0.075	40.523 (10.191)	0.273	3.89	0.005
ITG ↔ Thalamus	0.074	0.133 (0.033)	0.273	3.89	0.005
STG ↔ MTG	0.074	0.567 (0.143)	0.272	3.88	0.005
PoCG ↔ STG pole	0.074	0.017 (0.004)	0.271	3.87	0.005
IFG orbitalis ↔ SPL (RH)	0.073	3.066 (0.778)	0.271	3.86	0.005
pMFG ↔ IFG opercularis	0.073	1.138 (0.289)	0.270	3.85	0.006
AG (RH) ↔ GP	0.073	7.143 (1.818)	0.270	3.85	0.006
SPL (RH) ↔ GP	0.073	2.572 (0.655)	0.270	3.85	0.006
Hippocampus ↔ Putamen	0.073	0.831 (0.212)	0.270	3.85	0.006
MTG pole ↔ Putamen	0.072	0.291 (0.075)	0.268	3.81	0.007
Putamen ↔ pMTG	0.072	0.197 (0.051)	0.267	3.81	0.007
ITG ↔ LG	0.072	1.114 (0.287)	0.267	3.81	0.007
ITG ↔ Hippocampus	0.071	0.168 (0.043)	0.266	3.79	0.007
pMFG ↔ PrCG	0.071	1.178 (0.305)	0.266	3.78	0.007
MTG ↔ Cerebellum (RH)	0.070	18.432 (4.794)	0.265	3.77	0.008
IFG triangularis ↔ SMG	0.070	0.280 (0.073)	0.264	3.76	0.008
STG pole ↔ Midbrain (RH)	0.070	17.542 (4.580)	0.264	3.76	0.008
<b>Word Comprehension with Repetition covariate</b>					
MTG pole ↔ pMTG	0.092	0.356 (0.087)	0.303	3.97	0.004
<b>Noncanonical Sentence Comprehension with Repetition covariate</b>					
ITG ↔ Cuneus	0.116	0.604 (0.150)	0.341	3.91	0.004

AG (RH) ↔ LG (RH)	0.108	2.337 (0.602)	0.329	3.77	0.007
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See Supplementary Table 1 for region abbreviation definitions. All regions are left hemisphere, unless indicated as right hemisphere with (RH).  $\beta_u$  = unstandardized estimated beta coefficient, SE = standard error,  $\beta_s$  = standardized estimated beta coefficient, Z = Z-score,  $BF_m$  (null) = Bayes Factor index indicating support for the null hypothesis. See Supplementary Table 1 for region abbreviation definitions.