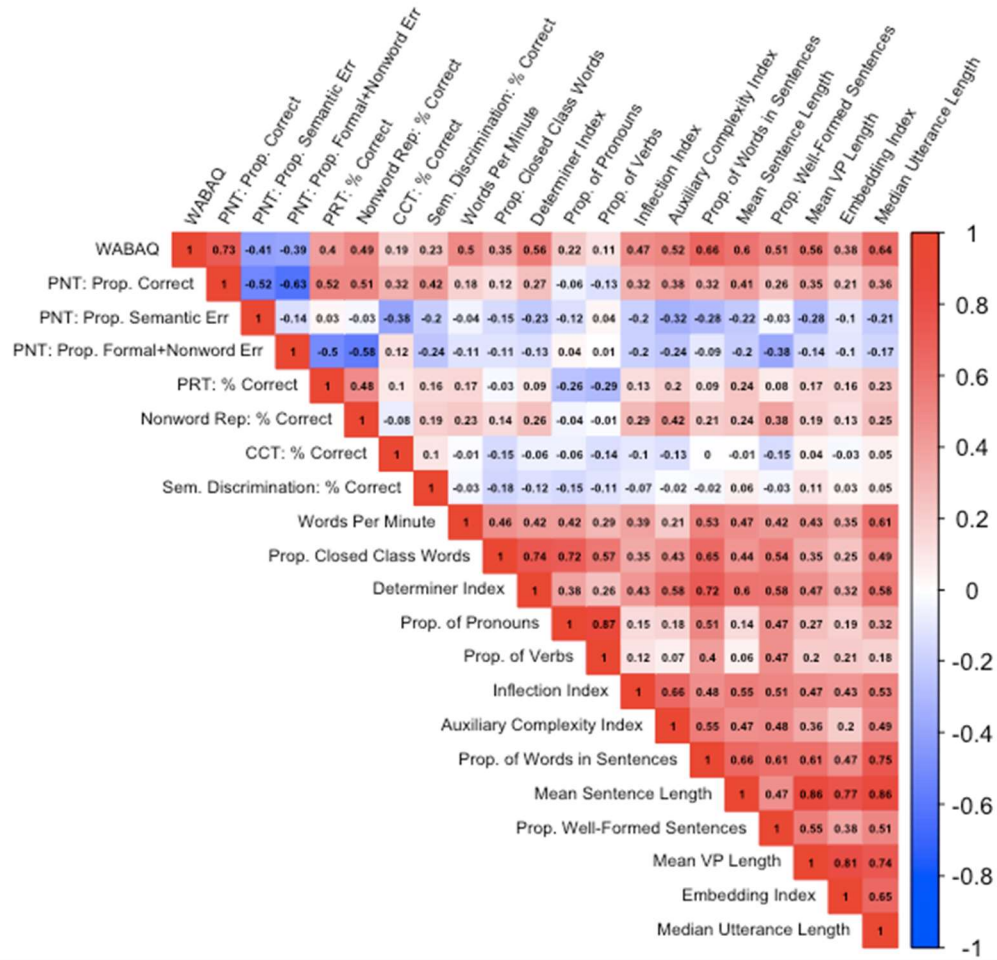
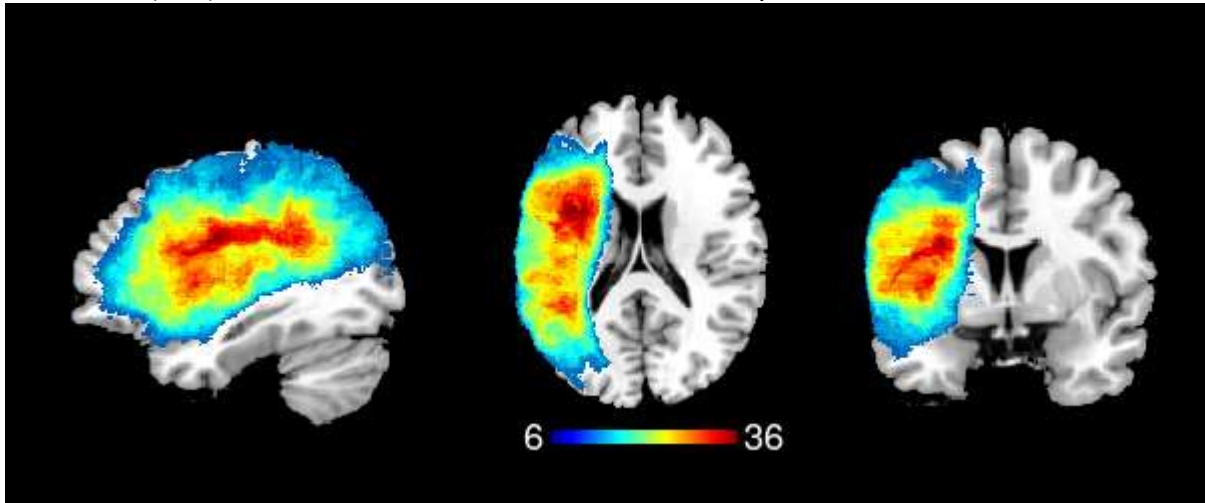


Supplementary material

Supplementary Figure 1: Bivariate correlations among behavioural measures.



Supplementary Figure 2: Lesion overlap map (at MNI coordinates, from left to right: $x = -36$, $z = 19$, $y = 3$). Colours show number of participants with a lesion in each voxel. Only voxels with $>10\%$ ($n=6$) lesion involvement were included in analyses.



Supplementary Table 1. Summary of QPA measures

QPA measures	Formula	Definition (based on Saffran et al., 1989)
Words per minute	Total words produced / Total number of minutes	Measure of speech rate
Proportion of closed class words	(Total narrative words – Open Class words) / Total narrative words	Closed class words: words that are not nouns, verbs, adjectives and adverbs (open class words)
Determiner index	Nouns with a required determiner / Nouns requiring a determiner	Proportion of nouns requiring determiners (proper nouns and plural forms might not require determiners depending on the context) that were produced with a determiner.
Proportion of pronouns	Pronouns / (Nouns + Pronouns)	Only personal pronouns are scored.
Proportion of verbs	Verbs / (Nouns + Verbs)	Verbs: all verb forms (infinitive, gerundive etc.), not limited to the main verb
Inflection index	Inflectable verbs that were inflected / Inflectable verbs	Verbs in inflected form (-s, -ies, -ed, -ied, -ing)
Auxiliary complexity index	(Total auxiliary score / Matrix verbs) - 1	Matrix verb: the main verb of an independent clause. Each auxiliary element of the matrix verb is assigned a score of +1, increasing the verb's score from the baseline of 1.
Proportion of words in sentences	Words in sentences / Total narrative words	Narrative words: all words that reflect the propositional speech produced as part of the narrative. Sentences: defined as an utterance following one of the following forms: (a) noun + main verb, (b) noun + copula + adjective, or (c) noun + copula + prepositional phrase
Mean sentence length	Words in sentences / Total sentences	
Proportion of well-formed sentences	Well-formed sentences / Total sentences	Well-formed sentences: sentences requiring at least a verb and a noun
Mean VP length	Words in Verb Phrases / Verb Phrases	Words in VP phrases: the sum of open class words + pronouns within the VP phrases.
Embedding index	Embeddings / Total sentences	The number of embedded clauses per sentence
Median Utterance Length	Median length of all utterances	Utterances refer to a sum of narrative words that forms a coherent, independent unit. These can be sentences, topic/comment statements, isolated narrative words or phrases, etc. Prosodic and syntactic indicators are considered for the segmentation of a speech sample into utterances.

Supplementary Table 2. Bifactor PCA factor loadings.

Measures	RC1 (Complexity)	RC2 (Lexical Syntax)	RC4 (Phonology)	RC3 (Semantics)
Mean Sentence Length	0.852	0.025	0.427	-0.028
Median Utterance Length	0.797	0.204	0.362	0.025
WAB AQ	0.785	0.175	-0.083	0.385
Mean VP Length	0.763	0.095	0.444	0.035
Inflection Index	0.689	0.114	0.115	-0.105
Naming Accuracy (PNT)	0.663	-0.133	-0.371	0.545
Proportion Words in Sentences	0.654	0.523	0.268	0.111
Embedding Index	0.648	-0.002	0.486	-0.110
Nonword Repetition	0.636	-0.037	-0.627	-0.043
Aux. Complexity Index	0.636	0.214	-0.027	0.015
Proportion Well-Formed Sentences	0.624	0.503	-0.086	-0.190
Determiner Index	0.594	0.489	0.167	0.001
Phonological Errors (PNT)	-0.538	0.085	0.695	0.132
Word Repetition (PRT)	0.530	-0.202	-0.682	-0.025
Proportion Verbs	0.018	0.865	-0.004	-0.075
Proportion Closed Class Words	0.397	0.778	0.059	-0.060
Proportion Pronouns	0.090	0.926	0.070	0.046
Words per Minute	0.509	0.381	0.123	-0.020
Semantic Discrimination	0.193	-0.179	-0.273	0.532
Semantic Errors (PNT)	-0.224	-0.082	-0.183	-0.773
Camel and Cactus Test	-0.033	-0.116	0.097	0.749
SS Loadings (Eigenvalues)	6.956	3.381	2.496	1.992
Proportion of Variance	0.331	0.161	0.119	0.095
Cumulative Variance	0.331	0.492	0.611	0.706

Supplementary Table 3. Spearman rank correlations between connectivity disruption measures and each behavioural measure. Overall lesion volume is included in both to show its relationship to behavioural measures as well as to measures of connectivity disruption.

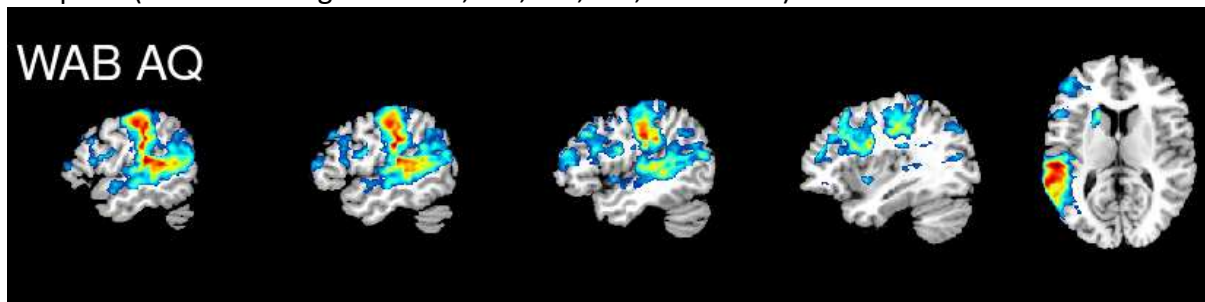
	Volume	Complexity	Lexical Syntax	Phonology	Semantics
Volume	-	-0.47 **	-0.331 *	-0.216	-0.244 .
Tracts					
AF	0.545 **	-0.316 *	-0.311 *	0.0445	0.0064
FAT	0.683 **	-0.366 **	-0.292 *	-0.217	-0.217
IFOF	0.543 **	-0.142	-0.020	-0.240 .	-0.250 .
SLF	0.736 **	-0.459 **	-0.359 **	-0.163	-0.00687
UF	0.527 **	-0.166	-0.0595	-0.204	-0.253 .
Whole-Brain Network					
Characteristic path length	-0.128	-0.0656	-0.0651	0.0318	-0.00483
Ave Clustering coefficient	0.322 *	-0.0236	-0.0899	-0.0596	0.0203
Global efficiency	0.0392	0.0742	0.0581	-0.0272	0.0367
Language Network					
Characteristic path length	0.566 **	-0.36 **	-0.278 *	-0.148	-0.0863
Ave clustering coefficient	-0.0247	-0.0749	0.152	-0.118	0.219 .
Global efficiency	0.0683	0.0166	0.136	-0.204	0.0272

Note: ** p < 0.01, * p < 0.05, . p < 0.1

Supplementary Analysis: Aphasia Severity (WAB AQ)

Because the first factor, Complexity, was closely related to aphasia severity, a comparison SCCAN LSM was conducted for WAB AQ alone, not combined with other measures as part of the first factor. WAB AQ score was associated with damage to a very similar (even larger) portion of the MCA territory (optimal sparseness = 0.798, CV correlation = 0.653, $p < 0.001$) that included parietal, temporal, and frontal regions (Supplemental Figure 3). The primary differences were that the lesion correlates of WAB AQ score extended more anteriorly into frontal regions (precentral gyrus, IFG, MFG), posteriorly into angular gyrus, and inferiorly into middle temporal gyrus.

Supplementary Figure 3. SCCAN LSM results for aphasia severity. The colours correspond to normalised SCCAN weights in the range 0-1. Results are shown on slices of an MNI template (from left to right: $x = -53, -50, -45, -36$, and $z = 11$).



In regression analyses of connectivity disruption, only lesion volume was a statistically significant predictor of WAB AQ (Supplementary Table 4). Neither tract-based nor graph theory measures of connectivity disruption accounted for significant variance in WAB AQ after lesion volume was taken into account.

Supplementary Table 4. Results of multiple regression with robust estimation of standard errors for connectivity disruption predictors of WAB AQ. Values show the regression coefficient estimate [95% confidence interval in brackets].

Tracts		
Volume	-0.10 [-0.14, -0.062] **	
Arcuate fasciculus	-0.028 [-0.15, 0.089]	
Frontal aslant tract	-0.052 [-0.13, 0.026]	
Superior longitudinal	0.031 [-0.1, 0.17]	
Uncinate fasciculus	0.057 [-0.068, 0.18]	
Inferior fronto-occipital	0.028 [-0.081, 0.14]	
Graph theory measures	Whole-brain network	Language network
Volume	-0.11 [-0.15, -0.067] **	-0.0072 [-0.011, -0.0037] **
Global efficiency	-860 [-3000, 1300]	-13 [-200, 170]
Ave clustering coefficient	3800 [-2100, 9700]	150 [-390, 700]
Characteristic path length	0.014 [-0.0084, 0.037]	0.00070 [-0.0013, 0.0027]