BOSTON UNIVERSITY

Introduction

- Feature processing is an integral component of semantic knowledge that involves accepting or rejecting typical, atypical and out-ofcategory features¹
- Semantic processing is mediated by the integrated functioning of anatomically-remote areas spanning frontotemporoparietal cortex in both healthy individuals and persons with aphasia (PWA)²⁻⁴



Figure 1. Schematic of semantic representation of category features. Pale blue = typical features, medium blue = atypical features, dark blue = out-of-category features

Figure 2. Critical brain regions involved in semantic feature judgment



Middle Frontal Gyrus (LMFG): ieral cognitive control erior Frontal Gyrus (IFG ntic access or contro

ddle Temporal Gyrus (MTG

 However, little is known about how stroke impacts the dynamic connectivity of such regions

Project Aims

- 1. To examine frontotemporal effective connectivity for semantic judgments in PWA relative to controls using dynamic causal modelling (DCM)¹⁰
- 2. To examine the relationship between connectivity parameters, behavioural performance and cortical damage in PWA

Participants

- 17 healthy controls (10M, mean age = 60.4 yrs)
- 16 PWA (10M, mean age = 64.9 yrs)

Table 1. Demographic and behavioural information for PWA

					Category	Semantic	Category
Participant	MPO	WAB AQ	PAPT	PALPA51	Superordinate	Feature	Coordinate
PWA 1	17	87.2	96	77	98	94	98
PWA 2	65	52	88	70	94	95	85
PWA 3	13	74.1	94	60	95	90	94
PWA 4	10	30.8	92	30	78	76	88
PWA 5	138	48	88	40	91	89	86
PWA 6	59	82.8	92	73	95	93	91
PWA 7	39	95.2	96	87	100	91	94
PWA 8	14	80.4	94	80	90	94	99
PWA 9	105	40	88	40	73	89	78
PWA 10	19	92.7	94	70	96	91	93
PWA 11	26	64.4	94	53	93	86	100
PWA 12	75	87.2	85	53	85	90	79
PWA 13	155	74.3	98	70	100	93	95
PWA 14	152	78	96	50	98	98	100
PWA 15	12	28.9	83	27	73	85	91
PWA 16	12	73.80	98.08	73.33	ND	ND	ND
AVG	56.94	68.11	92.25	59.58	90.60	90.27	91.40
STDEV	53.08	21.66	4.57	18.35	9.19	5.20	7.04

MPO = months post-onset; WAB AQ = Western Aphasia Battery Aphasia Quotient; PAPT = Pyramids and Palm Trees Test; PALPA 51 = Psycholinguistic Assessments of Language Processing in Aphasia, Subtest 51; ND = no data

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Frontotemporal effective connectivity during semantic feature judgments in patients with aphasia versus healthy controls Erin L. Meier & Swathi Kiran

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MRI Methods

- MR images acquired on a Siemens Trio TIM with a 20-channel head+neck coil
- T1 parameters: TR = 2300ms, TE = 2.91ms, 176 sagittal slices, 1x1x1mm voxels
- Functional parameters: TR = 2570ms, TE = 30ms, 40 axial slices, interleaved with 2x2x3mm voxels
- fMRI task included 54 experimental stimuli from 3 of 5 categories (i.e., *birds*, *vegetables*, fruit, clothing, and furniture) & 36 scrambled control stimuli

Figure 3. fMRI task. Example of event-related time series with experimental (i.e., real pictures), control (i.e., scrambled pictures), and fixation conditions



- Realignment with registration to mean Coregistration: functional image structural image



Effective Connectivity Methods: Dynamic Causal Modelling (DCM) VOI Selection Model Specification VOIs selected in 3 regions: LIFG, Bilinear, two-state, center input & LMFG & LMTG non-stochastic VOI = 8mm sphere eigenvariate All regions interconnected (A) Effect of pictures on regions (C) around peak and connections (B) Partitioning Inference Family-wise Bayesian Model 3 families, each with driving input to Selection (BMS) to determine one of the three regions: which set of models best fit the Family #1: Input to LIFG data¹¹ = **Model inference** Family #2: Input to LMFG Bayesian Model Averaging (BMA) Family #3: Input to LMTG within each family to yield values reflecting task-induced perturbation to regions (Ep.C) & modulation on connections (Ep.B) = **Parameter** inference

included in family #1 are shown for families #2 (i.e., driving input to LMFG) and #3 (i.e., driving input to LMTG).



Aphasia Research Laboratory

Conclusions

 LIFG plays a central role in semantic judgments in the healthy network⁷⁻⁸

In particular, LIFG and LMTG comprise a cohesive unit during normal processing

For PWA, tight coupling of LMTG to LIFG and LMFG was seen but heterogeneity within the group was also noted These results signify a patient network that is functionally distinct from that of healthy individuals

 No relationships found between connectivity metrics, behaviour and spared tissue in this three-node network Future work will explore relationships between *bilateral* connectivity, behavior and structural damage in PWA

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