



Making sense of the senseless: Abnormal brain connectivity in patients with schizophrenia during sentence processing



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Introduction

The language network

- The inferior frontal and temporal lobes of the brain are crucially involved in processing language in context and have been shown to be connected during language unification¹

The language network in patients with schizophrenia

- A 'loosening of association' is a core feature of schizophrenia that can manifest clinically as incoherent and disorganized language output².
- These abnormalities may be driven by an impairment in the use of context to predict and facilitate the processing of words that are semantically congruous with this context^{3,4}.
- Patients with schizophrenia can show abnormal increases in neural activity to words that are semantically unrelated to their preceding context⁵.
- Language and semantic abnormalities in schizophrenia have been linked to abnormal activity within the left inferior frontal cortex^{3,6} and to abnormal connectivity between frontal and temporal cortices^{7,8}.

Present study:

- In the present study we looked at activation and connectivity patterns to sentences versus wordlists in patients with schizophrenia and age and education matched control participants
- We hypothesize that we will find abnormal fronto-temporal connectivity patterns to sentences in the patient group.

Design

Sentences:

"The gray mouse quickly scurried underneath the dusty rug"

Wordlists:

"the during flour five the paintings fireworks were sea"

- Word by word presentation
- 300 ms/word, 100 ms blank
- No task

- 20 sentences/condition/subject
- Half of the items taken from Rogalsky & Hickok (2009)

Methods

Demographic and Clinical Information

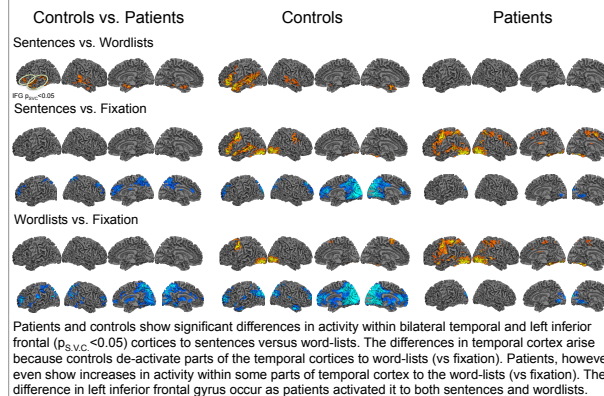
	Controls	Patients
Total	19	17
Male/Female	16/3	15/2
Age, y	45.4±6.8	44.6±9.0
Hollingshead Index	2.5±0.9	2.5±0.9
Education, y	12.9±1.2	13.1±2.2
Premorbid Verbal IQ	112.5±9.6	101.9±12.2
CPZ Equivalent	N/A	469.9±307.4
Duration of Illness, y	N/A	17.9±9.4

Analysis:

- Preprocessing and analyses of functional activations were run using SPM8⁹
- Motion was corrected using the ART toolbox¹⁰
- Connectivity analyses were run using generalised psycho-physiological interactions (gPPI)¹¹
- Statistical analyses were conducted using two-sample, between-subjects, t-tests
- Activations and connectivity patterns are shown at a voxel-level threshold of $p < 0.005$, cluster-level threshold, $p_{FWE} < 0.05$

Results

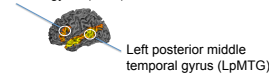
fMRI Activations



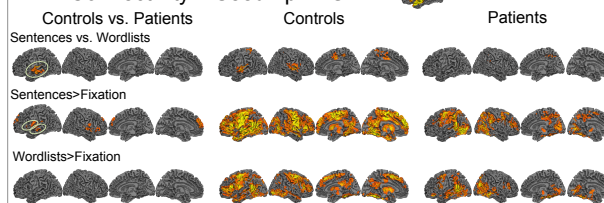
Seeds Connectivity Analysis

Left inferior frontal gyrus (LIFG)

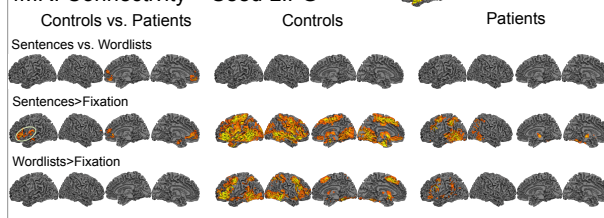
Seeds defined as 10 mm spheres based on peaks of activations in Sentences > Wordlist contrast in a group of 27 young adult controls



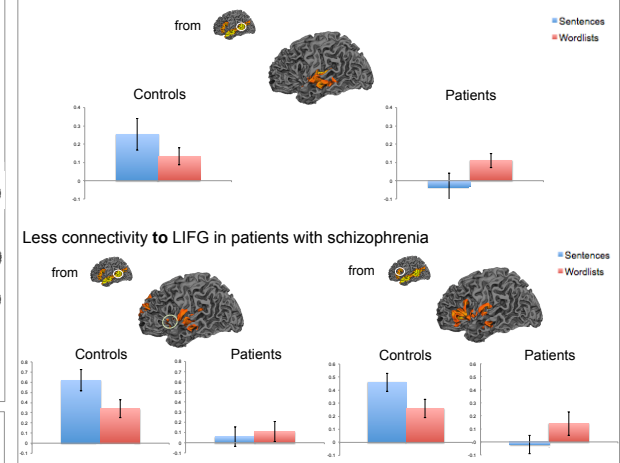
fMRI Connectivity – Seed LpMTG



fMRI Connectivity – Seed LIFG



The temporal lobe shows opposite connectivity patterns in patients & controls



Conclusions

- Patients with schizophrenia show abnormal activation and connectivity patterns within the language network
- The patient group shows as increased connectivity within the temporal lobe to wordlists (compared to sentences)
- Moreover, they show abnormally reduced fronto-temporal connectivity to both sentences as well as wordlists
- Patients may inappropriately engage the temporal lobes more when trying to make sense of the wordlists
- In patients the left IFG, which is key to semantic unification, to combine the words into a coherent whole, shows abnormal patterns of activation as well as connectivity
- These abnormal patterns of activation and connectivity may contribute to the disorganization of thought and language that characterizes schizophrenia

References

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