

# Assessing the role of temporal and frontal regions in syntactic comprehension: Insights from aphasia

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## Introduction

### Syntactic comprehension:

The ability to assign a hierarchical structure to a sentence in order to successfully interpret its meaning

### The debate:

- Current neurolinguistic models of sentence comprehension predict **just temporal** regions<sup>1</sup> or **both temporal and frontal** regions<sup>2,3</sup> to be crucial for syntactic comprehension
- Different types of non-canonical (“complex”) sentences structures are generally considered to investigate syntactic comprehension e.g., passive sentences, subject and object relative clauses

### This study:

- Aims to contribute to the debate on the role of frontal/temporal regions in syntactic comprehension through **lesion-symptom mapping analyses in a large cohort of stroke survivors**
- Explores whether the comprehension of **different “complex” structures** relies on **different** (frontal and/or temporal) **regions**

## Methods

### 120 participants with chronic post-stroke aphasia

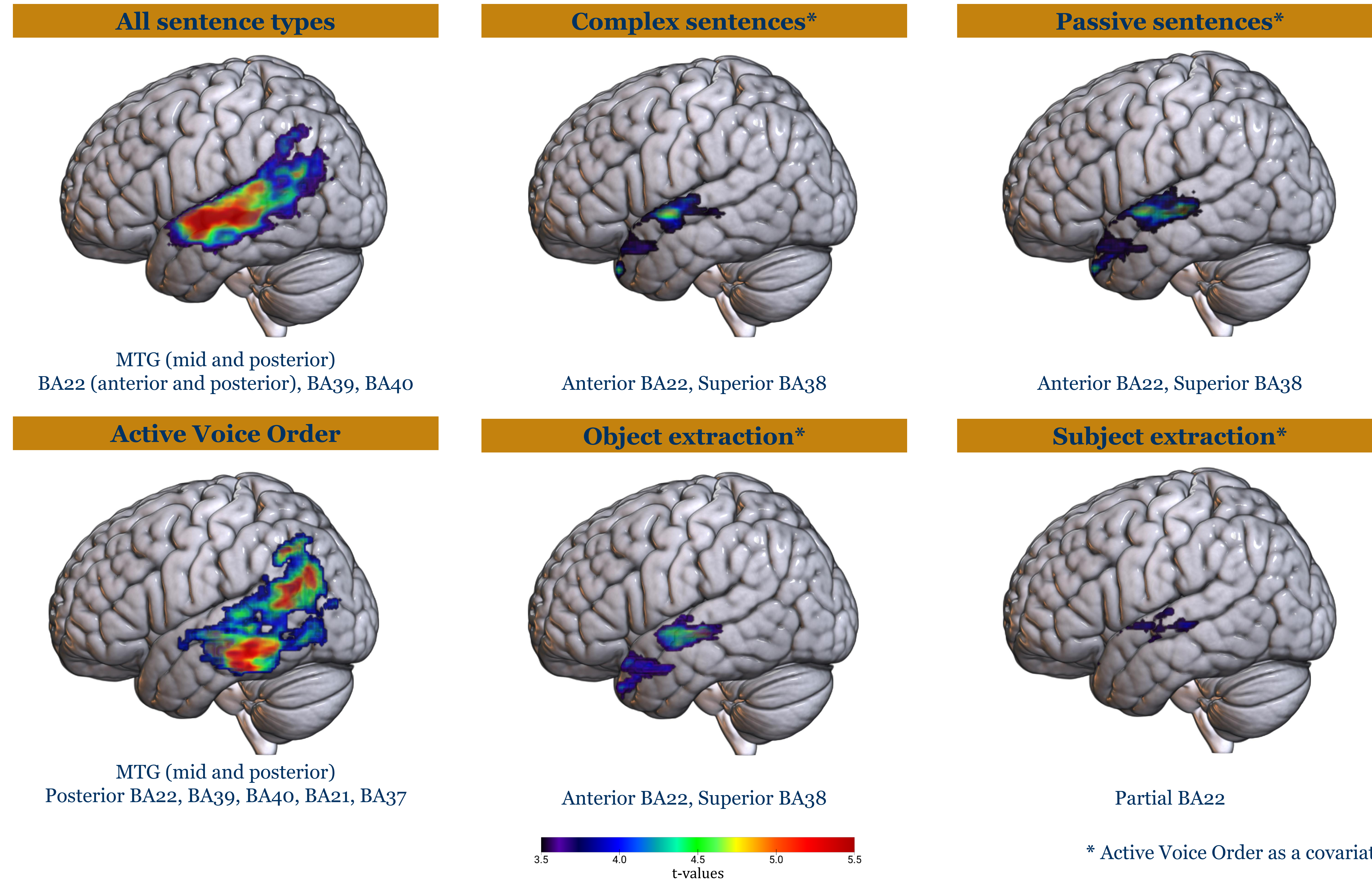
- Age range 31-86 years (M = 62 ± 12)
- Right-handed, English native speakers
- Single left-hemisphere lesion
- ≥ 6 months post-onset (range 7-329, M = 60 ± 69)
- > 8 years of education (range 10-20, M = 15 ± 2)

### Accuracy on selected subtests of the CYCLE-R test<sup>4</sup>, a sentence comprehension battery using a sentence-picture matching paradigm

### Univariate LSM analyses with permutation-based thresholding<sup>5</sup>

- Lesion size, Age, Time post-onset as covariates;
- Active Voice Order as an additional covariate in the analyses of non-canonical sentences (complex, object extraction, subject extraction, and passives)

## Results



## Discussion

### Temporal regions were found to be critical for syntactic comprehension

- Mid and posterior MTG and STG, supramarginal and angular gyri crucial for general syntactic comprehension
- Anterior STG crucial for syntactically-complex sentences

### No evidence for frontal involvement. Possible explanations:

- Deficits stemming from frontal lesions are well compensated for in the chronic phase
- Frontal regions play a secondary role in syntactic comprehension compared to temporal regions. Future multivariate analyses might help identify the role of these secondary regions

### Syntactic complexity is not monolithic

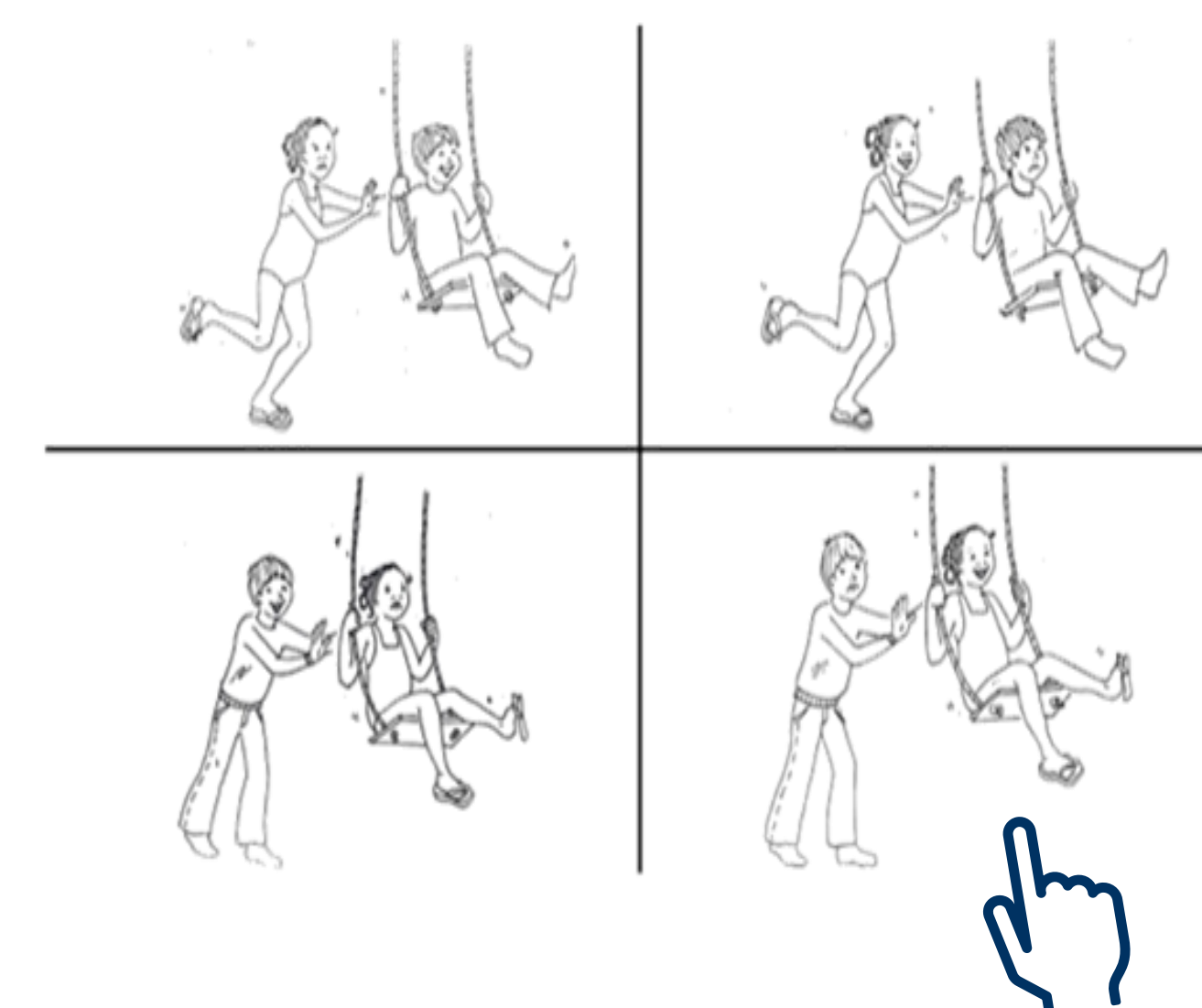
- In general, complex sentences need anterior BA22<sup>6</sup> and BA38
- However, if we consider different non-canonical (complex) sentence types separately, we notice:
  - Sentences that require the object/patient to be extracted and displaced from its canonical position (Object Extraction/Passives) require anterior BA22 and BA38
  - Sentences containing relative clauses with subject extraction require anterior BA22, but not BA38

### References

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### The task

 The girl who the boy is pushing is happy.



### Selected CYCLE-R Subtests

#### Simple Declaratives

#### Possession

#### Active Voice Order

#### Object Clefting

#### Relative Pronouns with Double function

#### Object Relatives with Relativized Object

#### Subject Relatives Ending in N-V

#### Object Relative Clauses

#### Double Embedding I

#### Passive Voice Order I

#### Passive Voice Order II

#### Negative Passive

### Sample sentence

The girl is sitting.

The clown has a balloon.

The girl is pulling the boy.

It's the clown that the girl chases.

The girl who the boy is pushing is happy.

The girl is kissing the boy that the clown is hugging.

The girl who is pushing the boy is happy.

The girl is chasing the clown who is big.

The clown that is big has a balloon that is blue.

The boy is being pushed.

The boy is being pushed by the girl.

The girl is not being led by the boy.

Object  
extraction

Subject  
extraction

Passive

Complex