

Linking production and comprehension - Investigating the lexical interface

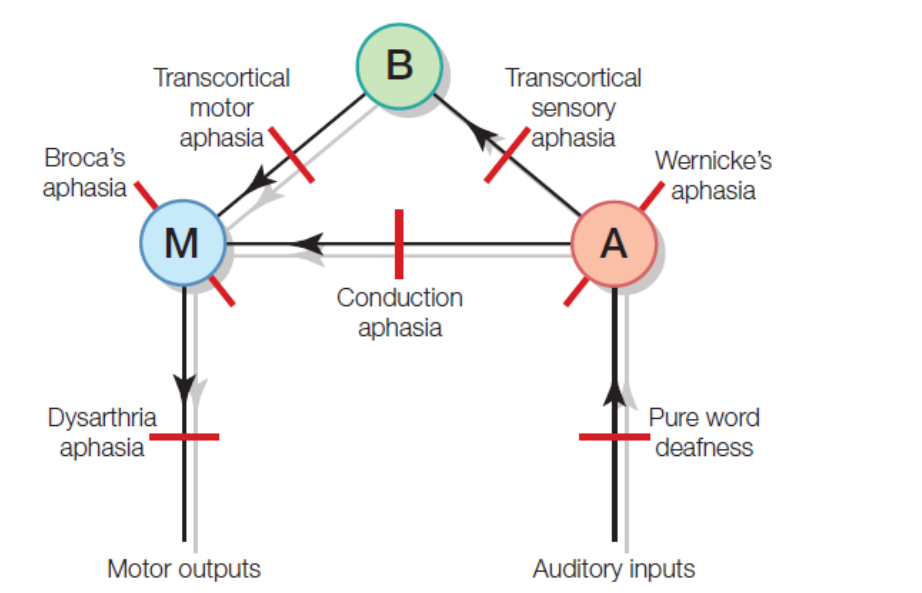
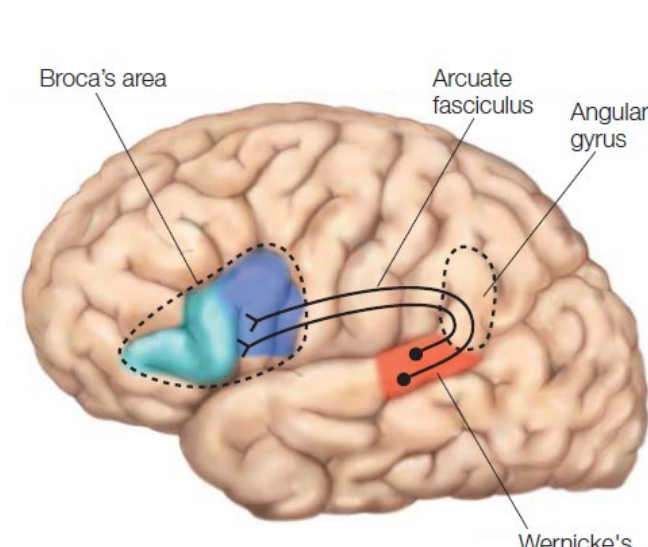
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INTRODUCTION

Why should we link them?

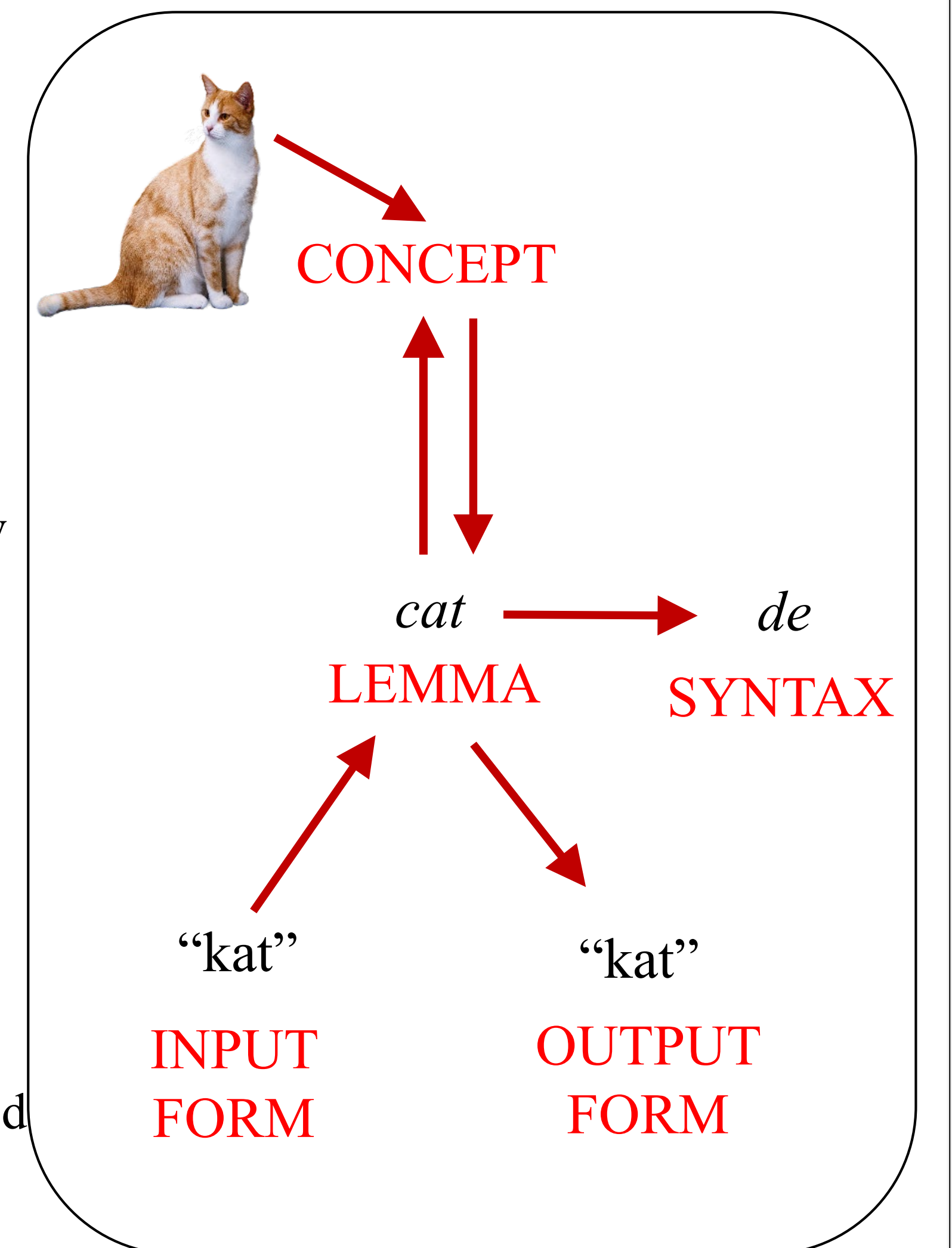
- Divide between language production and comprehension research theories



- However, BOTH production and comprehension difficulties present in aphasia [1]
- Core components underlying aphasic performance differentiate into factors such as lexical-semantic, phonological and executive-cognitive deficits & NOT production and comprehension deficits [2, 3]

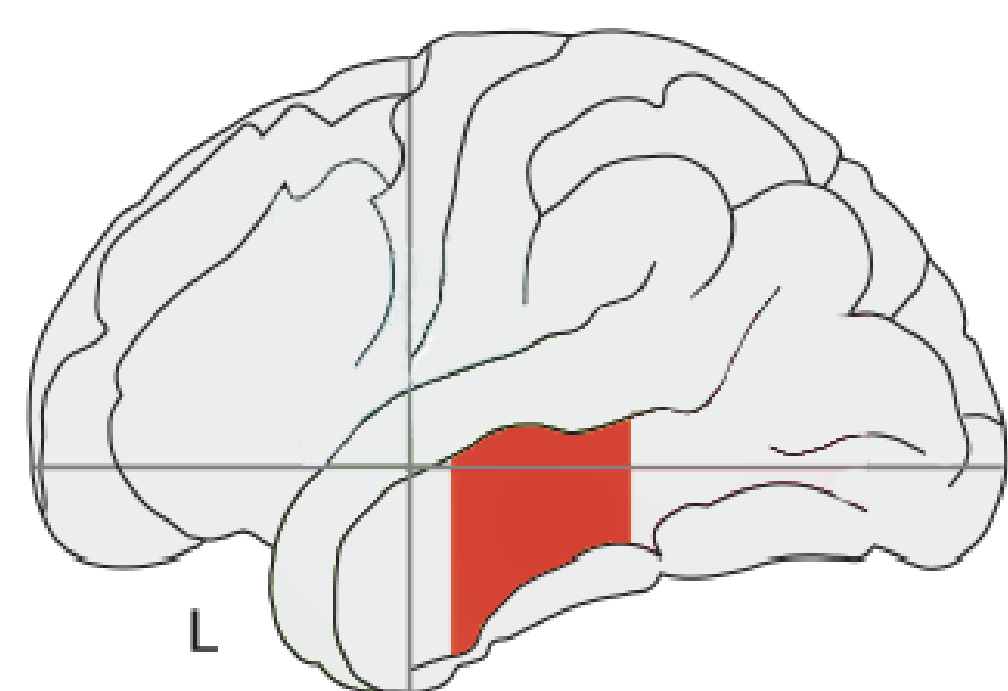
Background

- Shared conceptual level between production and comprehension [4]
- Lemma representations** map sound, meaning and syntax in **both speaking and listening** [4]
- Evidence from a meta-analysis, healthy and patient data point to **lemmas in left mMTG** [5 -9]
- Model simulations** applying lemma theory to aphasia and compatible with **lemma in left mMTG successfully simulate** production and comprehension data [10]
- However there are **counter views** –
 - Bilateral** lexical representations in posterior MTG [11]
 - No lemmas**; no role of left mMTG [12]
- Challenge: Lemmas are abstract so can't be studied with **one** task
- Current approach: Four tasks: lemmas should be accessed in semantic and syntactic tasks, both in listening and in speaking

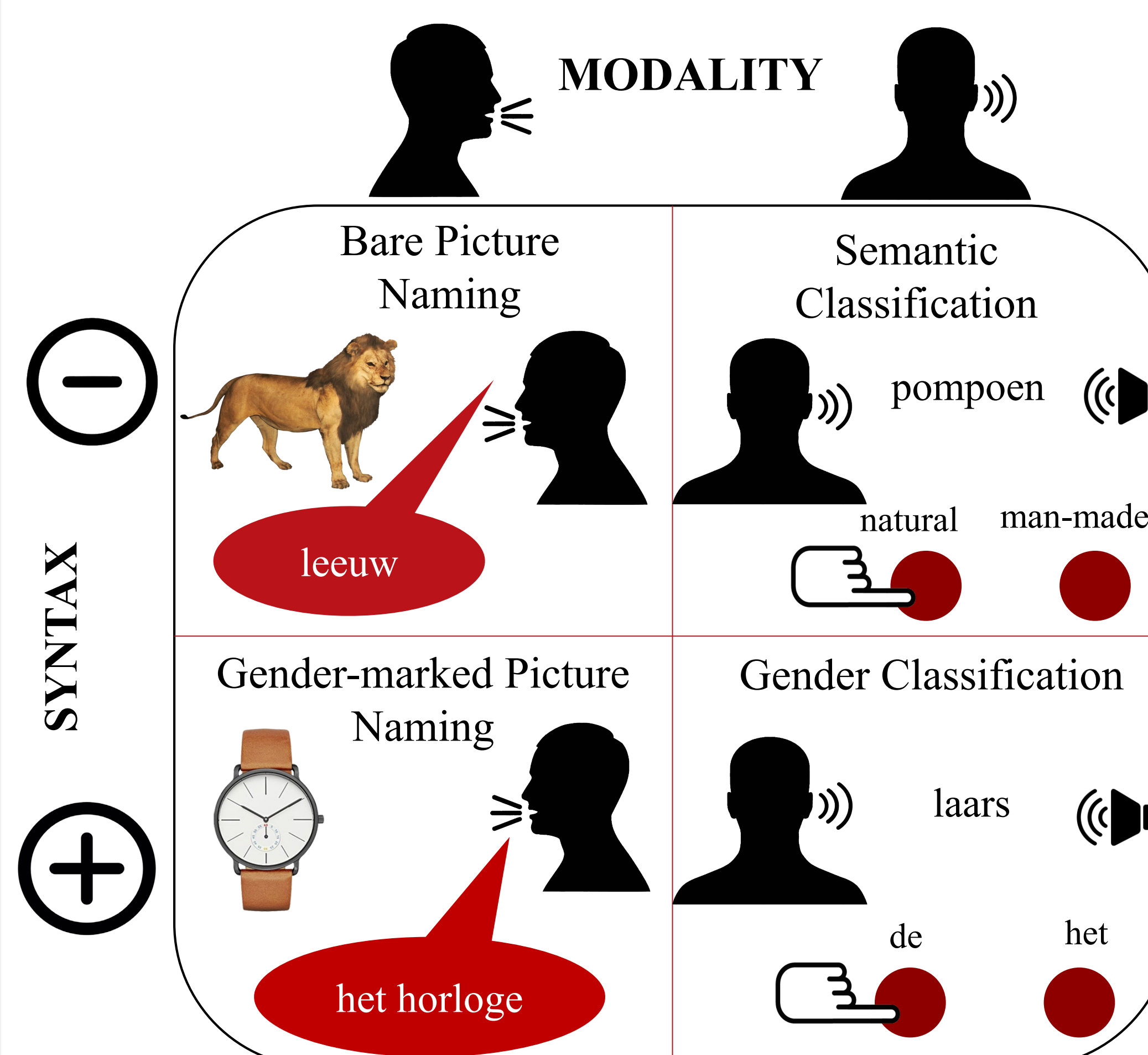


QUESTION

When performing **conjunction analysis** of activation across all four tasks, is **left mMTG** activated?

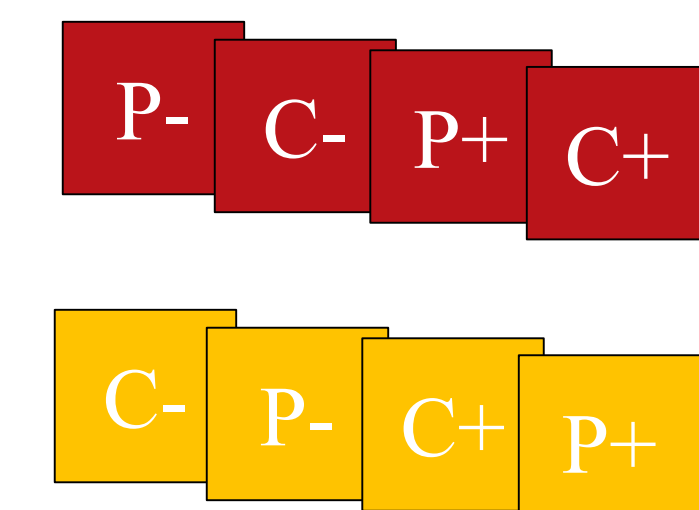


DESIGN + METHODS

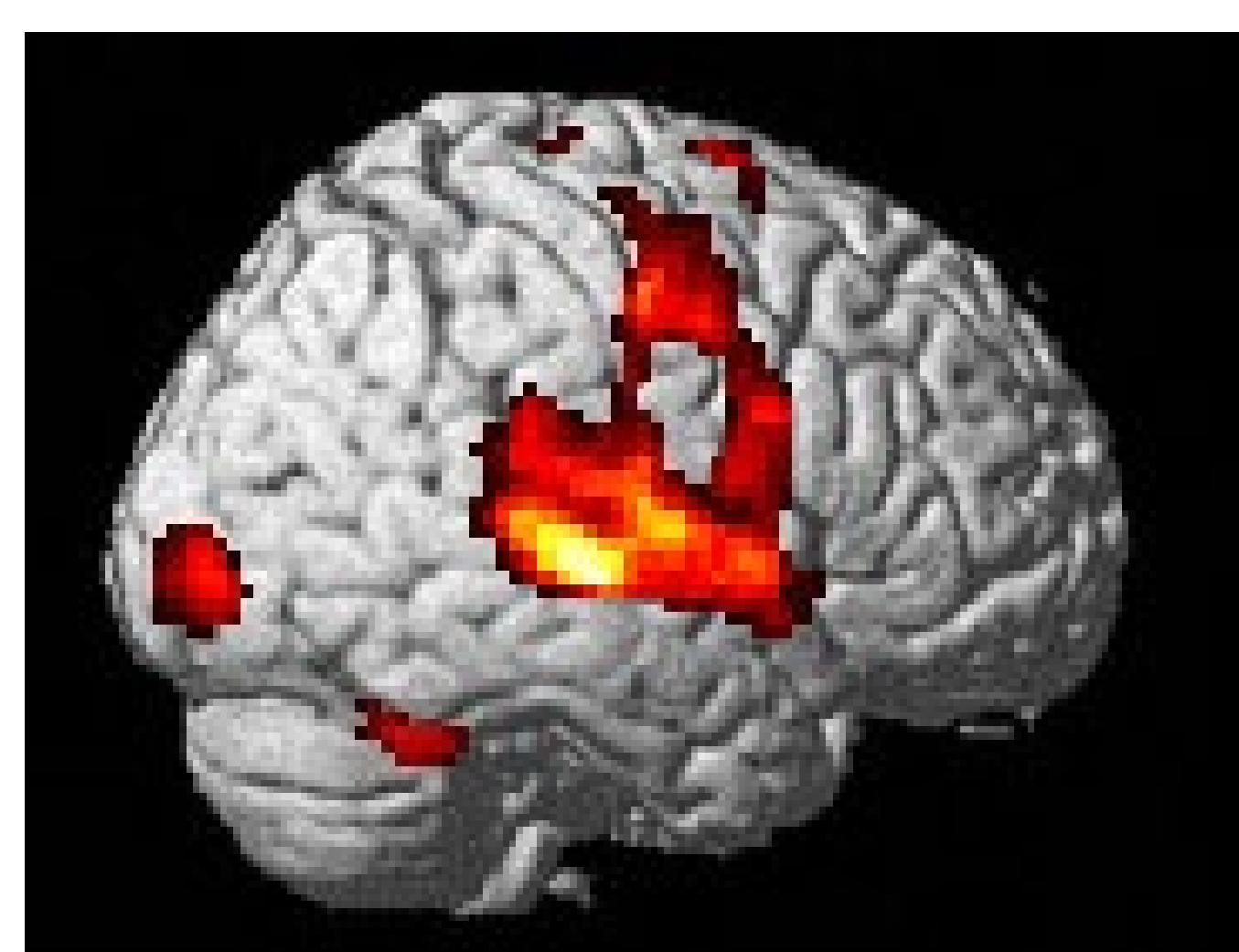


- 3T Siemens MRI scanner; Multi-band Multi-echo sequence; Preprocessing & Analysis in SPM 12
- 32 native Dutch speakers tested (2 excluded)
- 40 real pictures/words in each task
- For each task, active areas of the brain were determined.
- We searched for areas that were active in all four tasks (whole brain analysis).
- We further confirmed if all four tasks involved the left mMTG (ROI analysis).

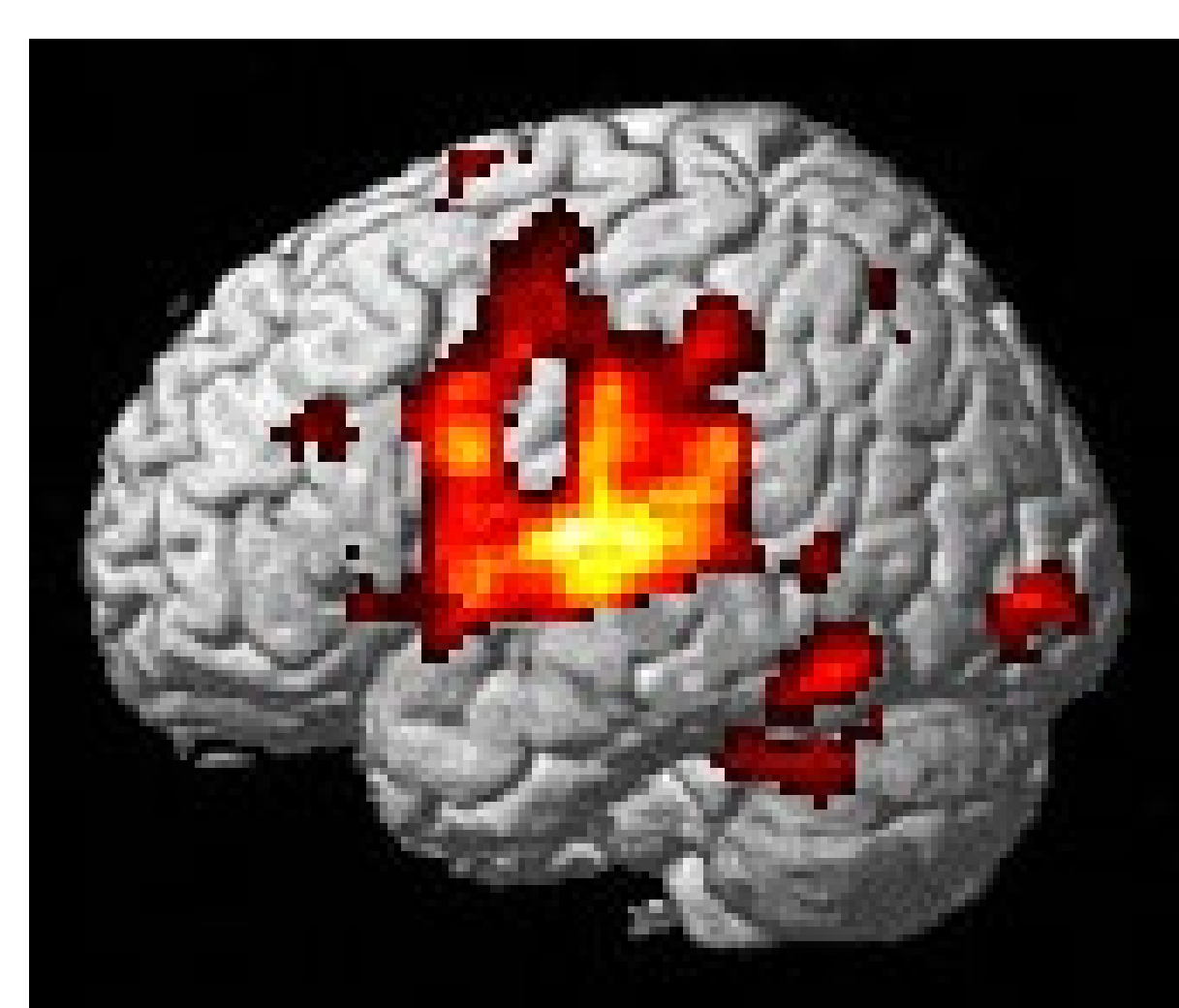
TASK ORDERS



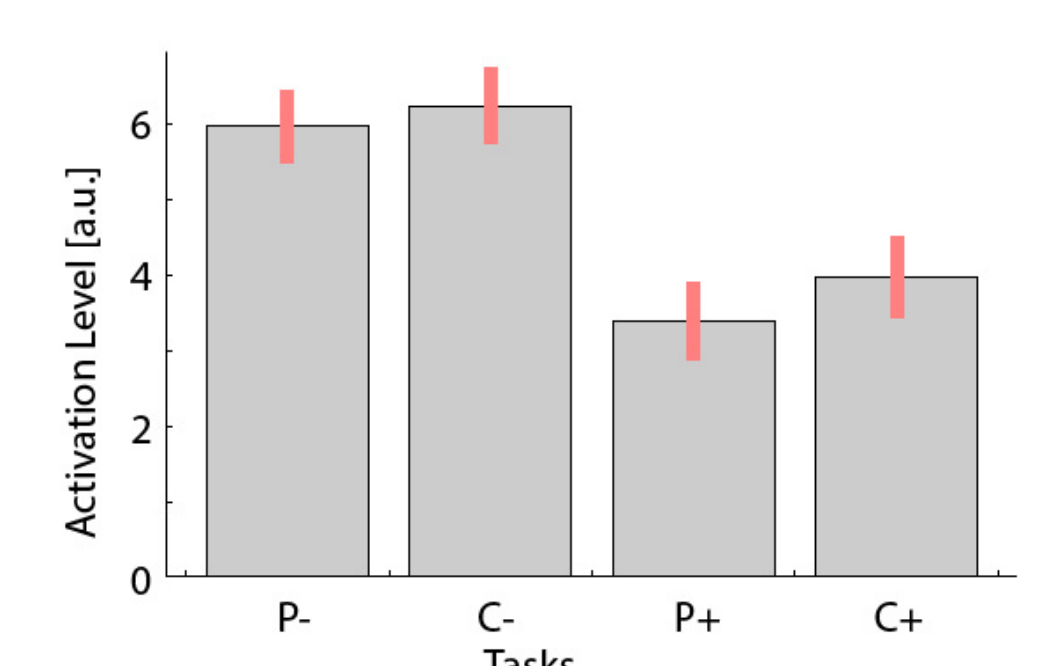
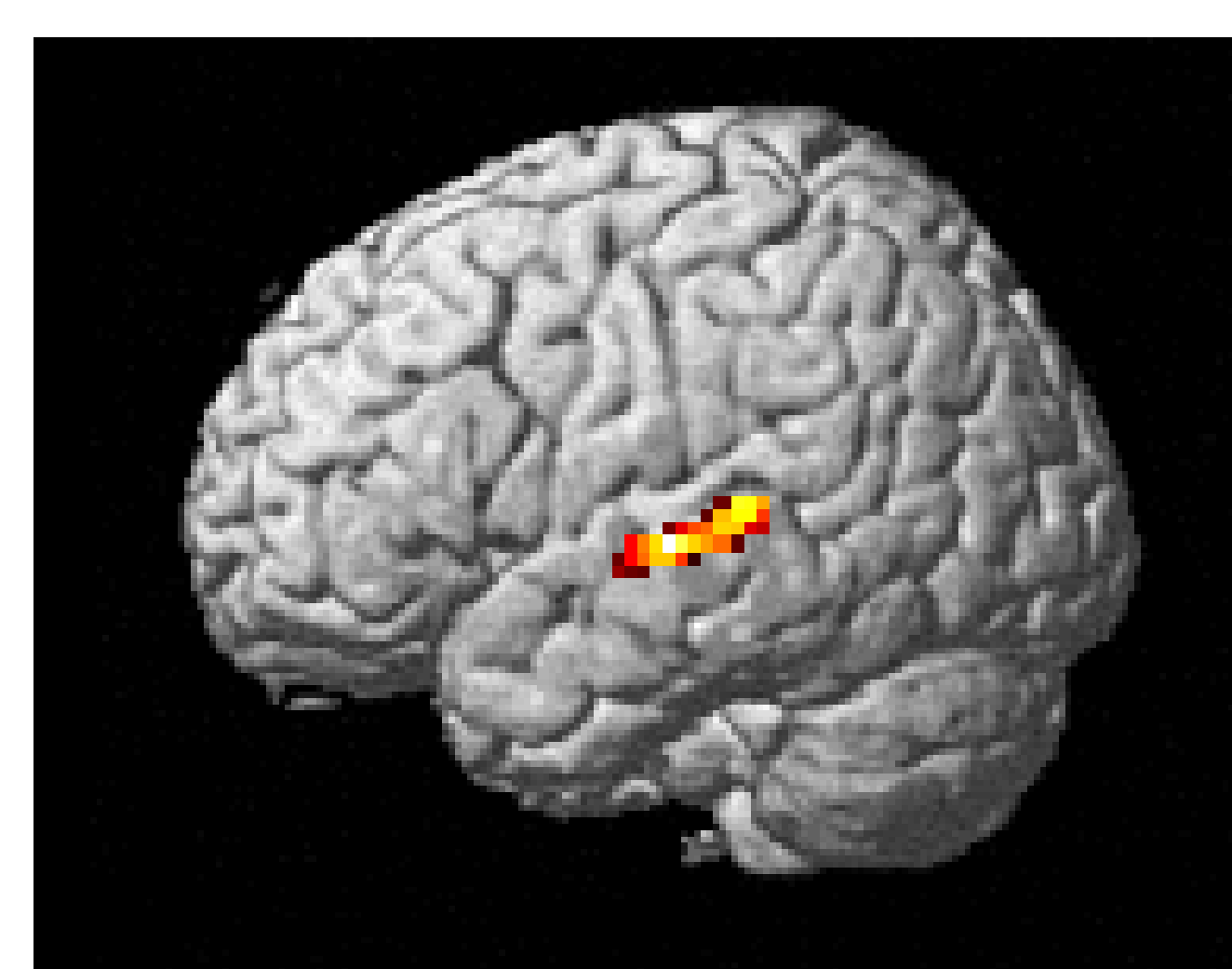
RESULTS & CONCLUSIONS



Whole brain analysis



ROI analysis
(left mMTG)



Activation level at peak voxel in left mMTG [-64, -22, 2]

- Left mMTG activated in all 4 tasks – plays a role in both speaking and listening to words; and in both semantic and syntactic tasks
- Evidence for shared neural circuitry in production and comprehension
- Unique approach to investigate lexical interface

REFERENCES

- [1] Charidimou, et al., J Clin Neurol, 2014
 [2] Butler et al., Brain, 2014
 [3] Fridriksson et al., PNAS, 2016
 [4] Levelt et al. Behavioral & Brain Sciences, 1999
 [5] Indefrey & Levelt, Cognition, 2004
 [6] Indefrey, Frontiers in Psychology, 2011
 [7] Dronkers et al., Cognition, 2004
 [8] Piai et al., PLoS ONE, 2014
 [9] Schwartz et al., Brain, 2009
 [10] Roelofs, Cortex, 2014
 [11] Hickok & Poeppel, Nature Reviews. Neuroscience, 2007
 [12] Ueno et al., Neuron, 2011

