Investigating the Lemma using fMRI – Linking Production and Comprehension

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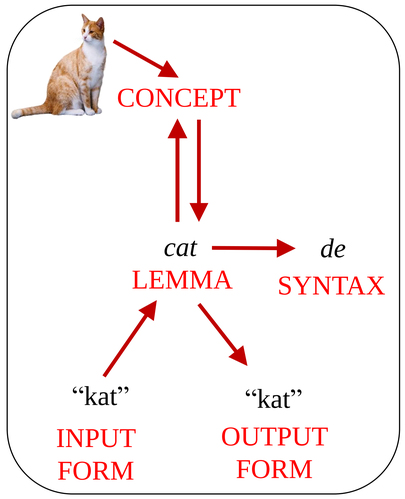
INTRODUCTION

BACKGROUND

- **Lemma representations** map sound, meaning and syntax in **both speaking and listening** [1]
- Shared conceptual and lexical level between production and comprehension [1]
- Evidence from a meta-analysis, healthy and patient data point to **lemmas in left mMTG** [2-6]
- **Model simulations** applying lemma theory to aphasia and compatible with **lemma in left mMTG successfully simulate** production and comprehension data [7]
- However there are **counter views** –
  - **Bilateral** lexical representations in posterior IT & MT [8]
  - **No** lemmas; no role of left mMTG [9]



CHALLENGE

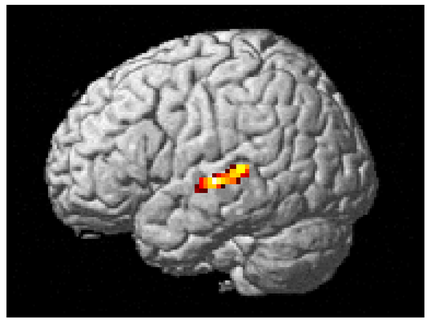
- Challenge: Lemmas are abstract and link other representations. Difficult to test empirically with one task [10]
- Current approach: Four tasks: lemmas should be accessed in semantic and syntactic tasks, both in listening and in speaking

QUESTION

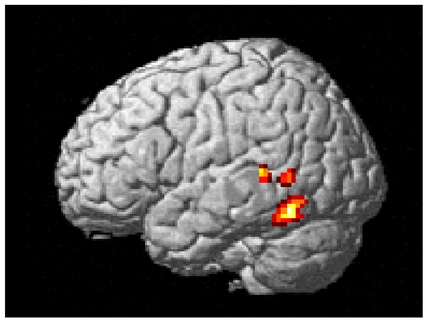
When performing **conjunction analysis** of activation across all four tasks, is **left mMTG** and/or **bilateral pIT & pMT** activated?

RESULTS

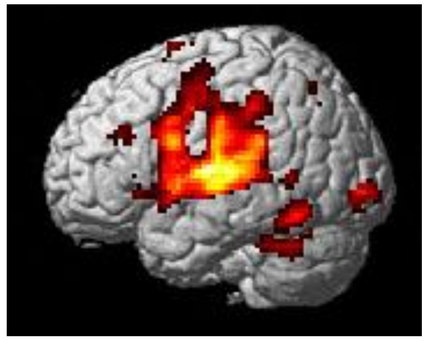
Left mMTG

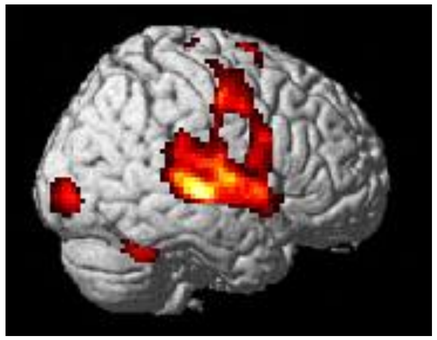


Bilateral pIT & pMT

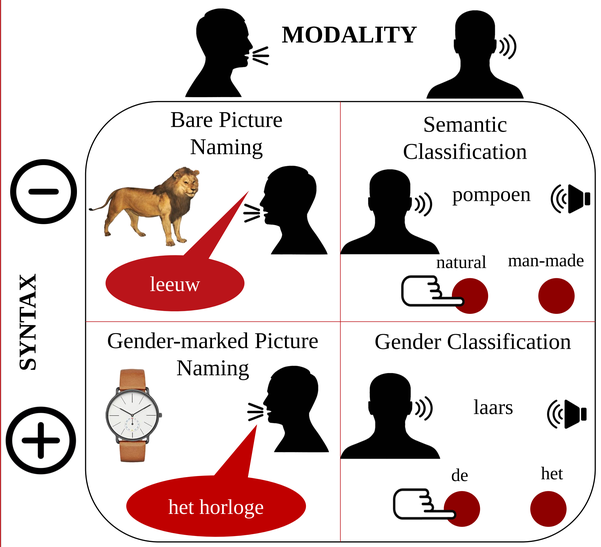


Whole brain analysis



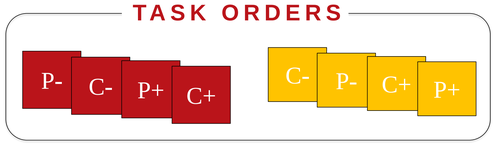


DESIGN + METHODS

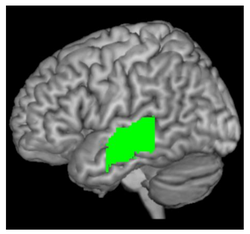


- 3T Siemens MRI scanner; Multi-band Multi-echo sequence; Preprocessing & Analysis in SPM 12
- 30 native Dutch speakers tested
- 40 real pictures/words in each task
- For each task, active areas of the brain were determined.
- We checked if all 4 tasks involved the left mMTG or in bilateral pIT & pMT (ROI analysis).
- We searched for areas that were active in all four tasks (whole brain analysis).

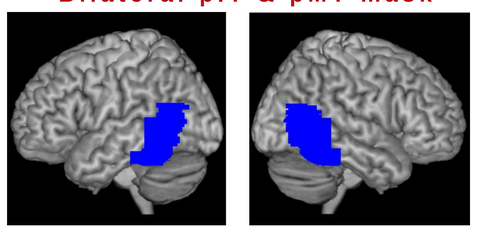
TASK ORDERS



Left mMTG mask



Bilateral pIT & pMT mask



CONCLUSIONS

- Left mMTG activated in all 4 tasks
- Only left pIT and pMT activated in all 4 tasks
- Evidence for shared neural circuitry in production and comprehension
- Unique approach to investigate lexical interface

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