Linking Production & Comprehension - Investigating the Lexical Interface

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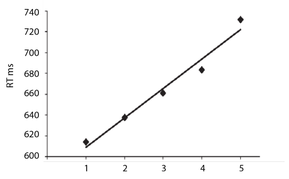
INTRODUCTION

- **Language production and comprehension** research and theories are often **disconnected**
- We investigated the **links** between production and comprehension with a **unique approach** using the same task set in 2 experiments – one behavioral and another fMRI

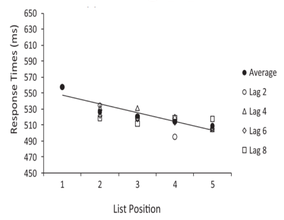
BEHAVIORAL

- **Cumulative semantic effects**
  - seen in tasks where **pictures from different semantic categories** are mixed up and presented one by one [1, 2]
  - **RT** analysed for increasing members within semantic category
  - Effect possibly **originates in conceptual level** [2,3] or in links between lemma and conceptual level [1]
  - **So far** tested **only for visual stimuli** with naming and classification

Is CS effect found in **listening** to spoken words? This would favour **shared conceptual level and lemma** between speaking and listening



Slowing in picture naming [1]

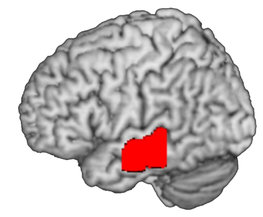


Speeding up in picture classification [2]

fMRI

- **Lemma representations** map sound, meaning and syntax in **both speaking and listening** [4]
- Evidence from a meta-analysis, healthy and patient data points 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: **abstract nature of lemma representations**
- **No single task** can be used to test for lemma representations because any task would involve other representations
- However, lemma should be accessed in **both listening and speaking tasks** and with **both semantic and syntactic task**

Can we map the lemma in the brain? Is such a mapping found in left mMTG?



DESIGN + METHODS

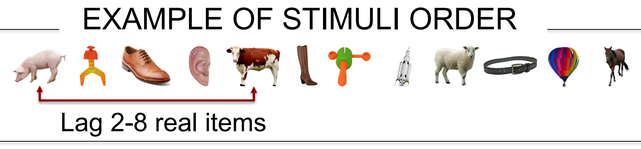
BEHAVIORAL

- 32 native Dutch-speaking participants
- 40 real and 20 pseudo words/objects per task
- 9 categories in each task with 4 items each; 4 filler items

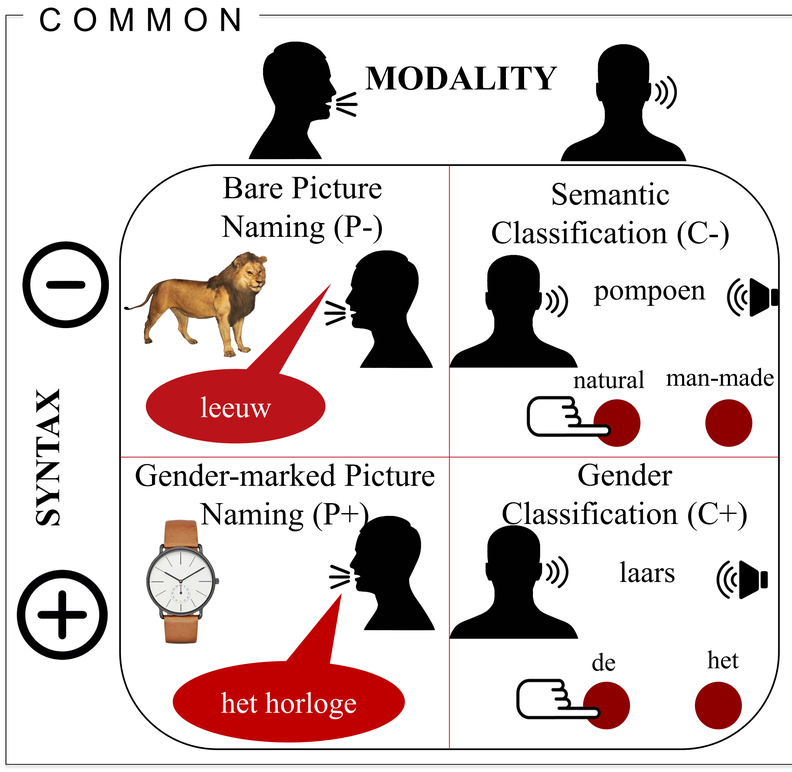
Analysis with Linear Mixed Effect Model

- Dependent variable : Reaction Time
- Fixed Predictor : Ordinal position within category
- Random Variable : Item and Subject

EXAMPLE OF STIMULI ORDER



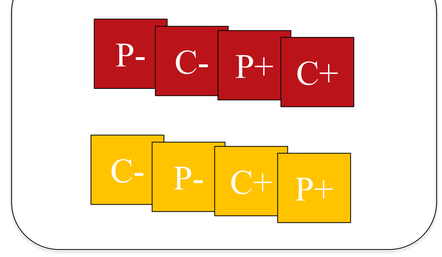
COMMON



fMRI

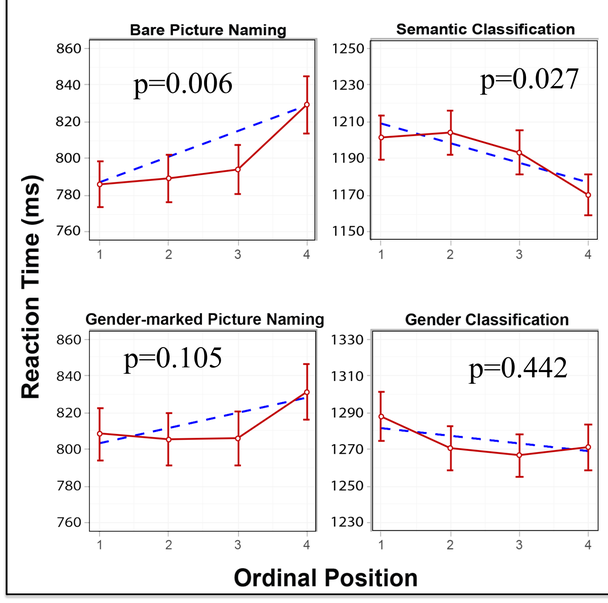
- 3T Siemens MRI scanner
- Multi-band Multi-echo sequence
- 32 native Dutch speakers tested (2 excluded)
- 40 real pictures/words in each task
- Preprocessing and Analysis in SPM 12
- Conjunction of activation maps across all four tasks

TASK ORDERS



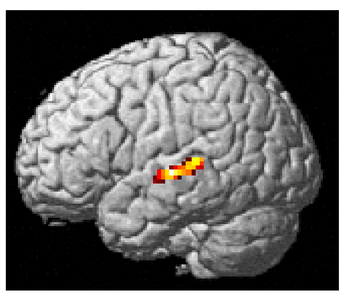
RESULTS & CONCLUSIONS

BEHAVIORAL



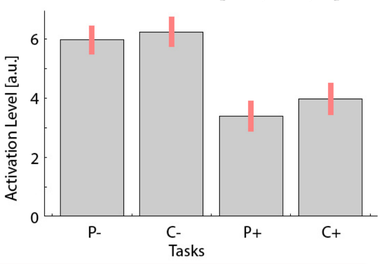
- Replicated CS interference in bare picture naming
- Found CS faciliation in spoken language comprehension
- Supports the notion of a shared lexical interface common to both language production & comprehension

fMRI



ROI analysis (left mMTG)

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



- Left mMTG activated across 4 tasks: role in both speaking and listening to words; and in both semantic and syntactic tasks
- Evidence for shared neural circuitry in production and comprehension, across conceptual and syntactic levels

Cumulative semantic facilitation found in listening task + Lemma mapped to left mMTG

shows shared mechanisms across language production & comprehension

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