Precision of neural codes involved in storing phonological information in working memory

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Introduction

Working memory (WM) precision

- Is the **resolution or fidelity** with which items are stored in WM (Joseph et al., 2015, Ma et al., 2014)
- Has to be distinguished from WM **capacity**, defined as the number of items that can be stored in WM
- Has been extensively studied in the visual field, (e.g., Gorgoraptis et al., 2011; Zokaei et al., 2012), but much less in the auditory-verbal domain

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Introduction

Aims of the study

- Explore the precision of neural representations associated with verbal WM memory using functional magnetic resonance (fMRI)
- Use of a multivariate decoding approach (Multivoxel pattern analysis, MVPA)
- Investigate the extent to which neural patterns can distinguish between nonwords varying in their level of phonological overlap

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Methods

- Participants (young adults, N = 27) were presented auditorily with a set of six nonwords
- One single nonword was presented per trial
- Nonwords were either **phonologically overlapping** or **non-overlapping**; each nonword was presented **24 times**
- After encoding, the nonword had to be maintained for **7000 ms**
- Neural patterns associated with each nonword were examined using MVPA and searchlight analyses 1) at **encoding**, and 2) during **maintenance**

Nonword Stimuli	
Overlapping	Non-overlapping
Cordoriment	Debundageau
Corpomirent	Panfinouran
Cormopirent	Loncechetait

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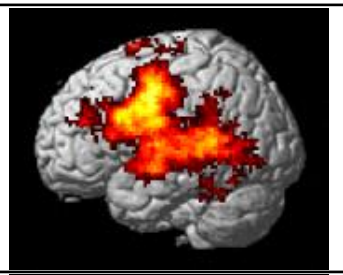
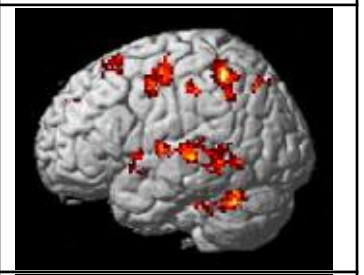
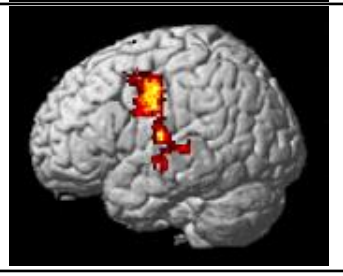
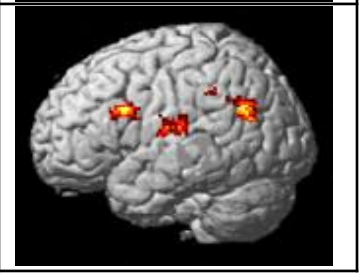
Results

- One-sample t-tests compared classification accuracies and normalized classification accuracy maps to a chance-level distribution
- Above chance-level accuracies in the dorsal language pathway known to be involved in phonological processing

		BF_{10}	error%
Encoding	Non-overlapping	1158.372	4.037^{e} -6
	Overlapping	0.333	0.027
Maintenance	Non-overlapping	8.738	7.983^{e} -4
	Overlapping	0.362	0.029

pFWE-corr < .05 FWEc = 36-38	Encoding	Maintenance
Non-overlapping nonwords		
Overlapping nonwords		

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Discussion

- Phonological information represented in a **larger network for non-overlapping nonwords** versus overlapping nonwords
  - More robust and precise representations
- Receptive and productive parts of the **dorsal language network**
- Contribution of **inferior parietal regions** involved in WM processing and attentional focalization during **maintenance** of **non-overlapping nonwords**
- **Role of phonological processing neural network** in encoding and maintenance of WM content

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