



Detection of language network during free speech using Optically Pumped Magnetometers (OPMs)

Josefina Weinerova¹, Ryan Hill², Roni Tibon¹

¹ School of Psychology, University of Nottingham

² Sir Peter Mansfield Imaging Centre (SPMIC), University of Nottingham



Background

- Episodic memory encoding and retrieval are continuous processes.
- There is a shift to more naturalistic approaches in studying memory [1,2].
- Many imaging modalities are sensitive to head movements artefacts.

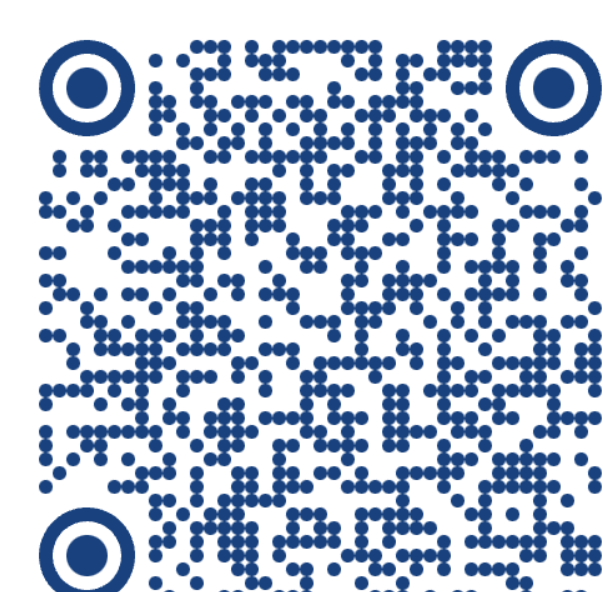
→ We aim to develop and validate a method to analyse brain signals during continuous speech (and ultimately verbal recall) using the OPM MEGs.

OPM MEGs [3]

- Uses magnetic fields sensors mounted flexibly in light-weight helmet
- Sensitivity and spatial resolution increased.
- Operate at room temperature
- More resilient to movement artifacts

Goals

Finding comparable linguistic effects in the overt and covert condition at the sensor and source level.



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Methods

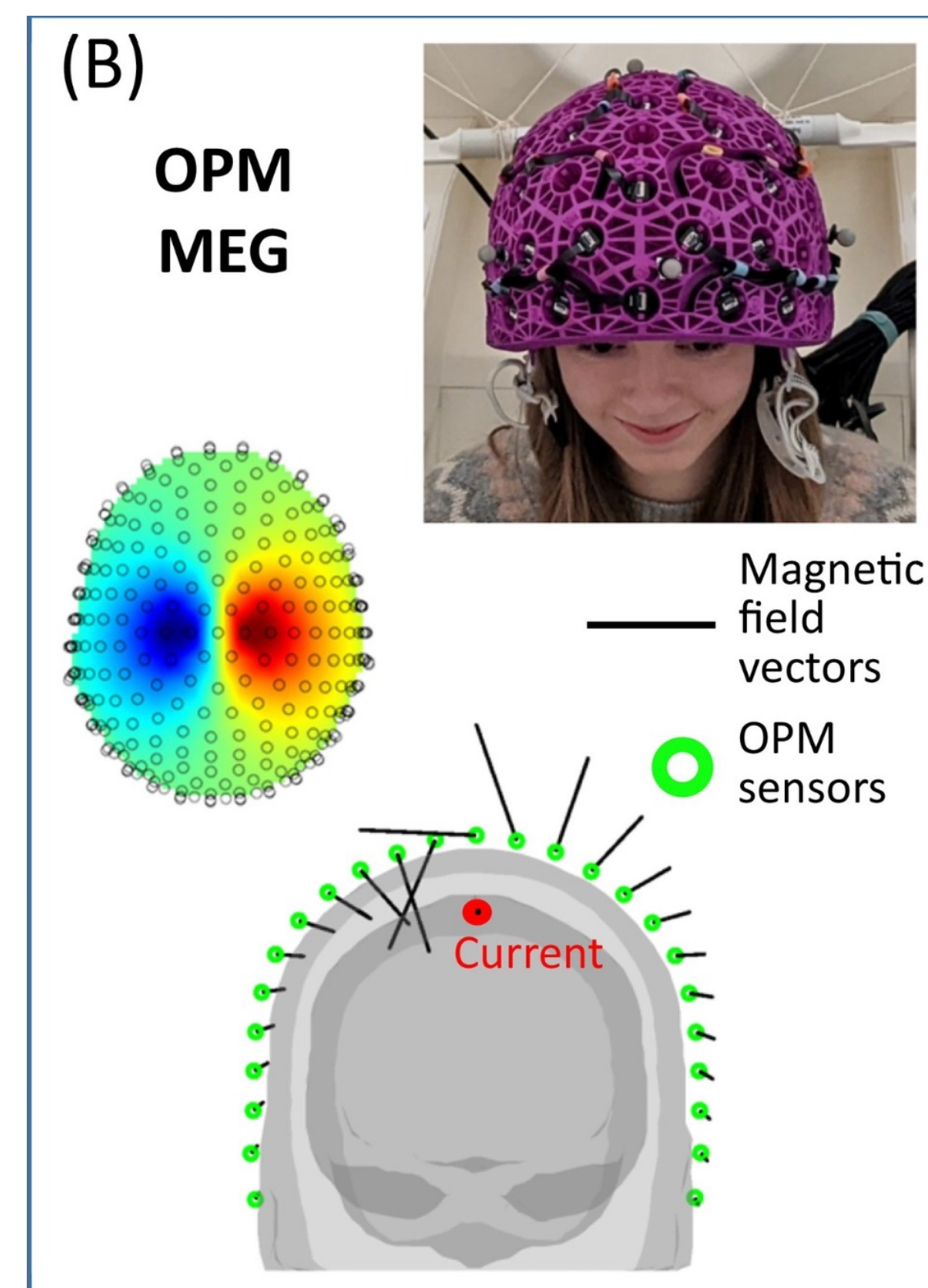


Figure 1 adapted from Brookes et al. (2022) [3]. A schematic representation of OPM MEG.

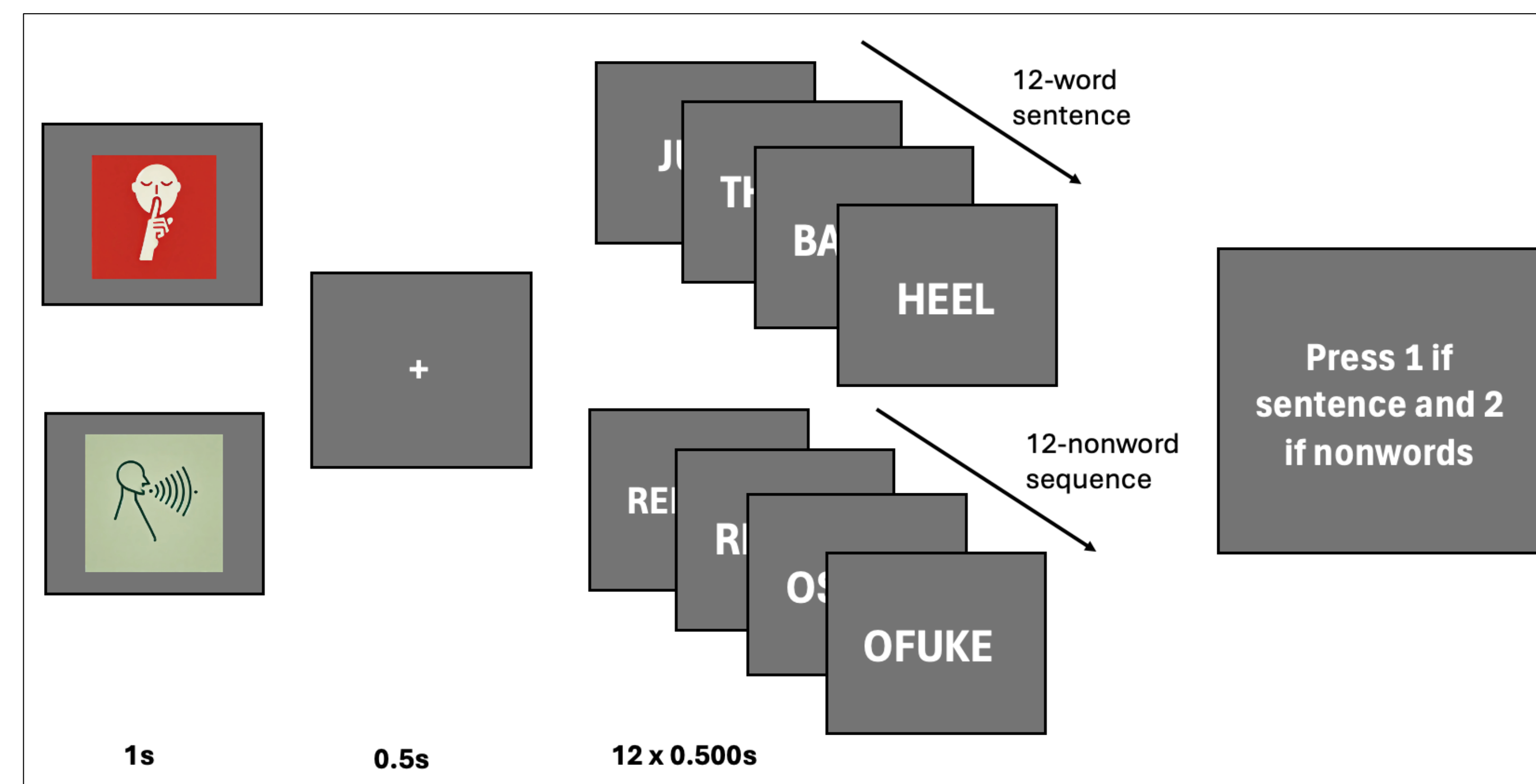
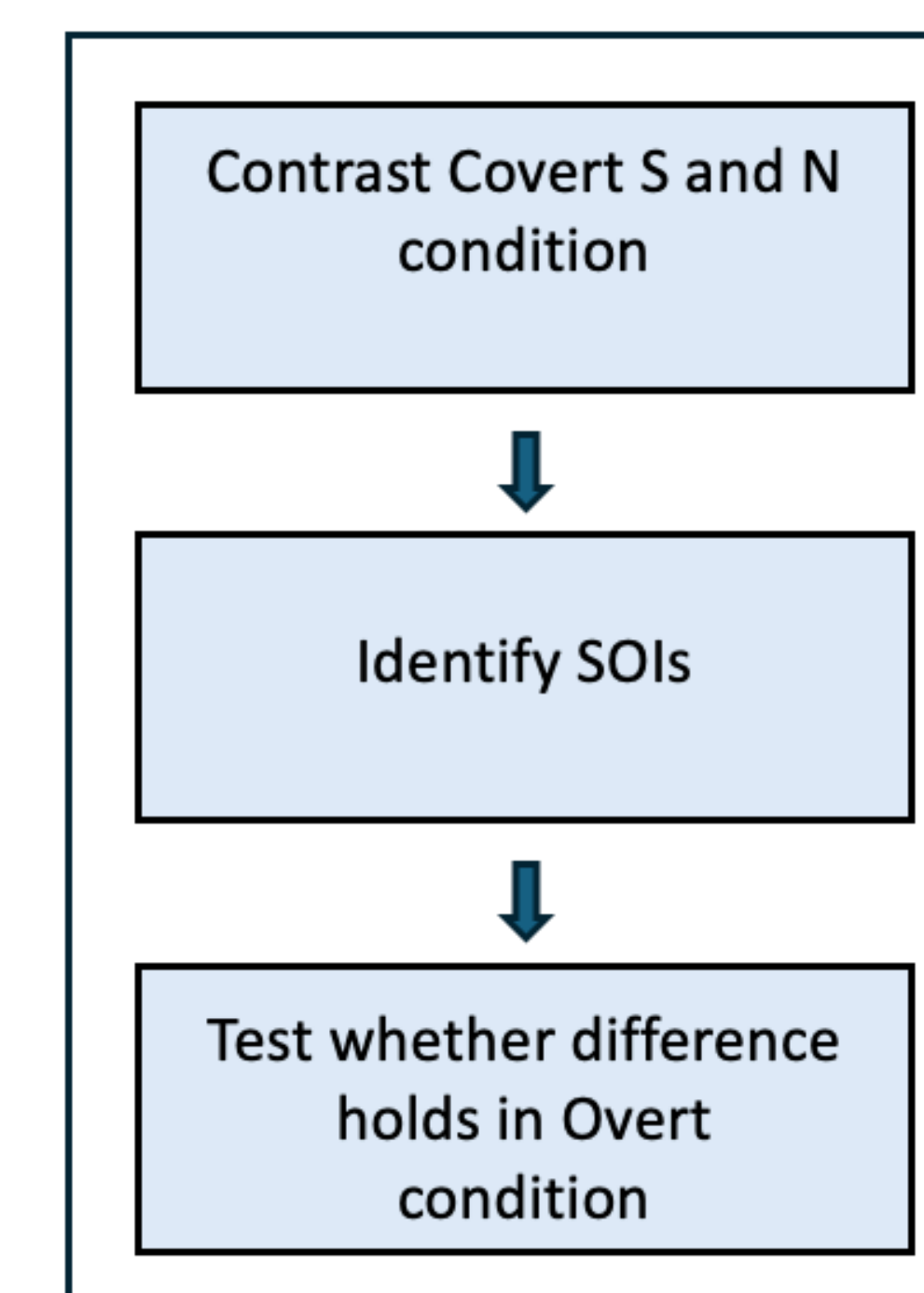


Figure 2 The Rapid serial visual presentation task. Stimuli were adapted from Fedorenko et al. (2010) [4]. Participants are asked to read sentences and nonword sequences aloud and silently.

- Participants – native English speakers
- Right-handed
- No known developmental conditions affecting language
- 4 conditions: covert (C) and overt(O) reading of sentences (S) and nonwords (N)
- 80 trials per condition

Proposed analyses

- ✓ Identify sensors of interest (SOIs) where differences between sentence and non-word trials exists in the covert condition, separately for each participant.
- ✓ Examine whether differences in subject-specific SOIs remain in the overt condition.
- ✓ Explore these effects across various frequency bands.
- ✓ Apply source localisation techniques (such as Beamforming) to identify brain regions (e.g., within the language network) associated with sentence vs. non-word trials in the covert and overt conditions.



References

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- [4] Fedorenko, E., Hsieh, P.-J., Nieto-Castañón, A., Whitfield-Gabrieli, S. & Kanwisher, N. New Method for fMRI Investigations of Language: Defining ROIs Functionally in Individual Subjects. *Journal of Neurophysiology* **104**, 1177–1194 (2010).
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