Looking for the Phonological Mapping Negativity (in all the wrong places)

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Section 1

Introduction

Event-related potentials

Event-related potentials (**ERP**) are measured brain responses that are direct result of a **sensory**, **cognitive** or motor event (**Luck 2005**)

Event-related potential components are measured with electro-encephalography (**EEG**) equipment.

Event-related potentials

Event-related potentials **can inform us about cognitive time-lines during processes such as** online language processing and **speech perception**. ERP can be exploited to investigate architectures of grammar e.g.

- Information flow order during speech perception
- Mental representations

Phonological Mapping Negativity

The Phonological Mapping (or Mismatch) Negativity, **PMN** is an event-related potential component hypothesized to index pre-lexical phonological processing (**Connolly and Phillips 1994**; **Connolly et al. 2001**; . . .)

Phonological Mapping Negativity

However, while some studies (e.g. **Connolly and Phillips 1994**) have linked the PMN to phonological mapping during the lexical selection stage of speech perception, others (e.g. **Newman & Connolly**) report the ERP response is a marker of **acoustic and prelexical information**.

Phonological Mapping Negativity

Lewendon et. al (2020) suggest that the possibility exists that the PMN is an extension of either the Mismatch Negativity (**MMN**) or N400 components (**Kutas and Hillyard 1980; Naatanen 1991**)

Research question

- **Is the PMN in response to acoustic, phonetic, phonological, lexical mapping and mismatch, none or a combination of all?**

Why the PMN.. and why now?

- The PMN might play an important role in future investigations of architectures of grammar (placed in between acoustic and lexical processing)
- Clinical studies have used the PMN as a **marker of phonological processing abilities**. However, it is not clear what exactly the PMN stands for.

Section 2

Methods

Experimental design

Three neuroimaging experiments designed to introduce new contexts in which to probe the elicitation of the PMN ERP component. Experiments 1, 2, and 3 were designed to work independently while being fully comparable.

Equipment

Data collection

- 64 active pin-type **BioSemi** electrodes / *ActiView*
- Neurobehavioral Systems' **Presentation**

Software

- MATLAB (2018b; 2019a; 2019b)
- EEGLAB (**Delorme & Makeig 2004**)
- ERPLAB (**Lopez-Calderon & Luck, 2014**)
- R (4.1) (**R Core Team 2021**)

Software

Data analysis

- Exploratory channel-level multivariate testing with package `ERP` (**Causeur et al. 2020**) and the Adaptive Factor Adjustment (AFA) procedure (**Sheu et al. 2016**)
- Mean amplitude modelling with package `lme4` (**Bates et al. 2015**)

Data visualisation

- Grand-Average / difference ERP plots with `ggplot2` (**Wickham 2016**)
- Cubic spline interpolation scalp maps with package `akima` (**Akima and Gebhardt 2020**)

Reproducibility

Averaged ERP data, statistical analysis code and model outputs / summaries, as well as visual exploration for all experiments, are freely available on GitHub at the repository `mcanzi/phd_codedata`

Thesis has been submitted and **will be available through open access** following thesis defense (in August) and corrections.

Section 3

Experiment 1

Methods

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Methods

Results

Results

Discussion

Discussion

Section 4

Experiment 2

Methods

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Methods

Results

Results

Discussion

Discussion

Section 5

Experiment 3

Methods

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Methods

Results

Results

Discussion

Discussion

Section 6

General Discussion

Thank you!

References

Questions?