

Event Related Potentials revealed early (150 ms) rhyming effects for single letters

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Introduction

- Sublexical (letter) orthographic processing was postulated to proceed to sublexical phonological processing and then to whole-word representations^[1]
- N1 (negativity at ~170 ms) has been associated with orthographic processing because ERP differences exist between orthographic (letter/word) and non-orthographic (pseudoletter/pseudoletter strings) stimuli^[2-9]
- However, phonological processing of words was shown to begin by 150 ms^[10], which can occur before the N1 orthographic effects
- Recording ERPs during a single-letter rhyme/nonrhyme judgement task might help identify when sublexical phonological processing is occurring.
- However, sublexical phonological studies using rhyming tasks only found significant ERP rhyme effects for single-letters at around 450 ms^[11,12], well beyond lexical retrieval.
- In an attempt to clarify the timing of orthographic and phonological processing for single-letters, we replicated a single-letter orthographic study^[3] and a phonological study^[11] in a single group of adult participants.

Methods

- 15 adults (ages 20-35; 8 female), English first-language
- 64-channel ActiView2 BIOSEMI system, re-referenced to linked mastoid

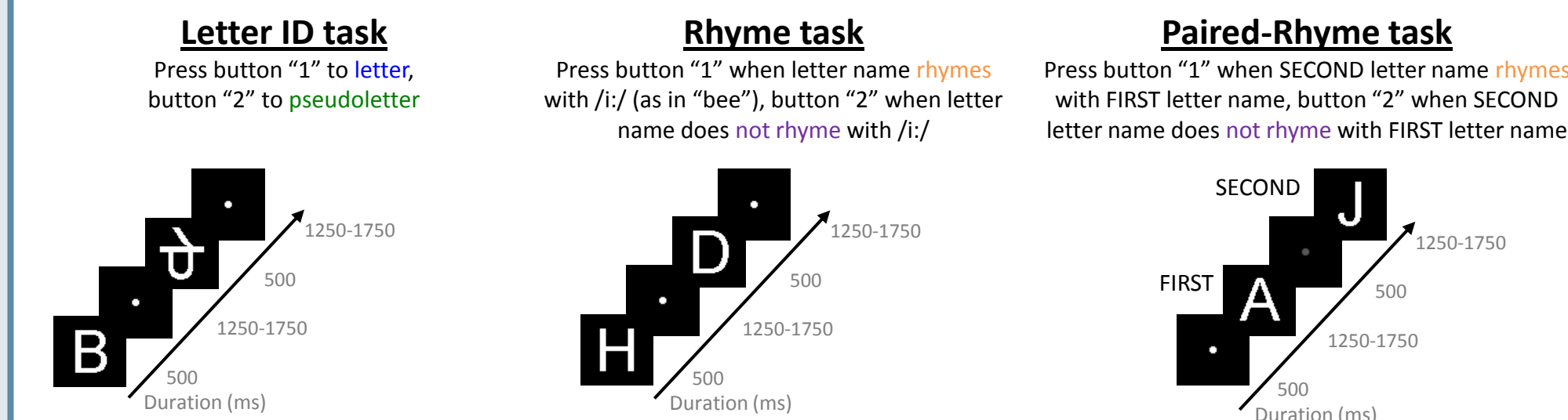
- Stimuli: Letter

A	B	D	E	G	H	J	N	P	R	T	U
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Pseudoletter

X	ϕ	Q	ϒ	Ɑ	Ɱ	Ɐ	Ɒ	ⱱ	Ⱳ	ⱳ	ⱴ
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- Three two-forced choice tasks:



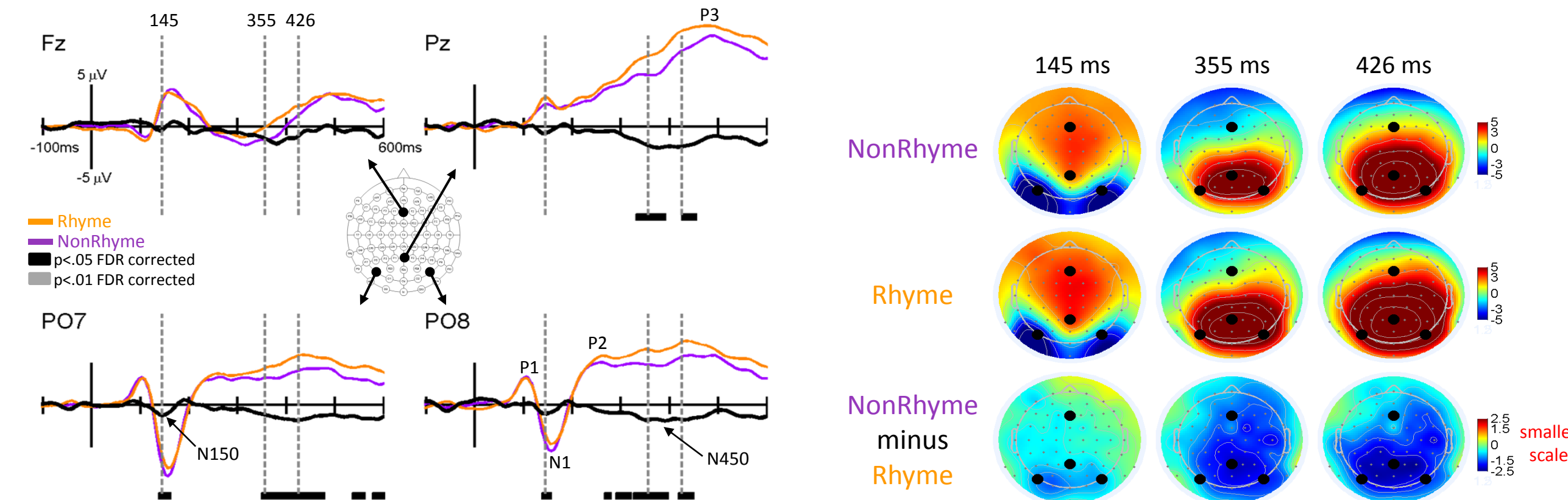
Behavioural Results

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- Reaction Times were 18 ms faster to Letter than Pseudoletter stimuli ($p<.01$) with no difference in % hits ($p=.85$)
 - Reaction Times were 27 ms faster to Rhyme than NonRhyme stimuli (Rhyme Task only; $p<.01$) with 3% more hits to Rhyme than NonRhyme stimuli ($p<.01$)

ERP Results

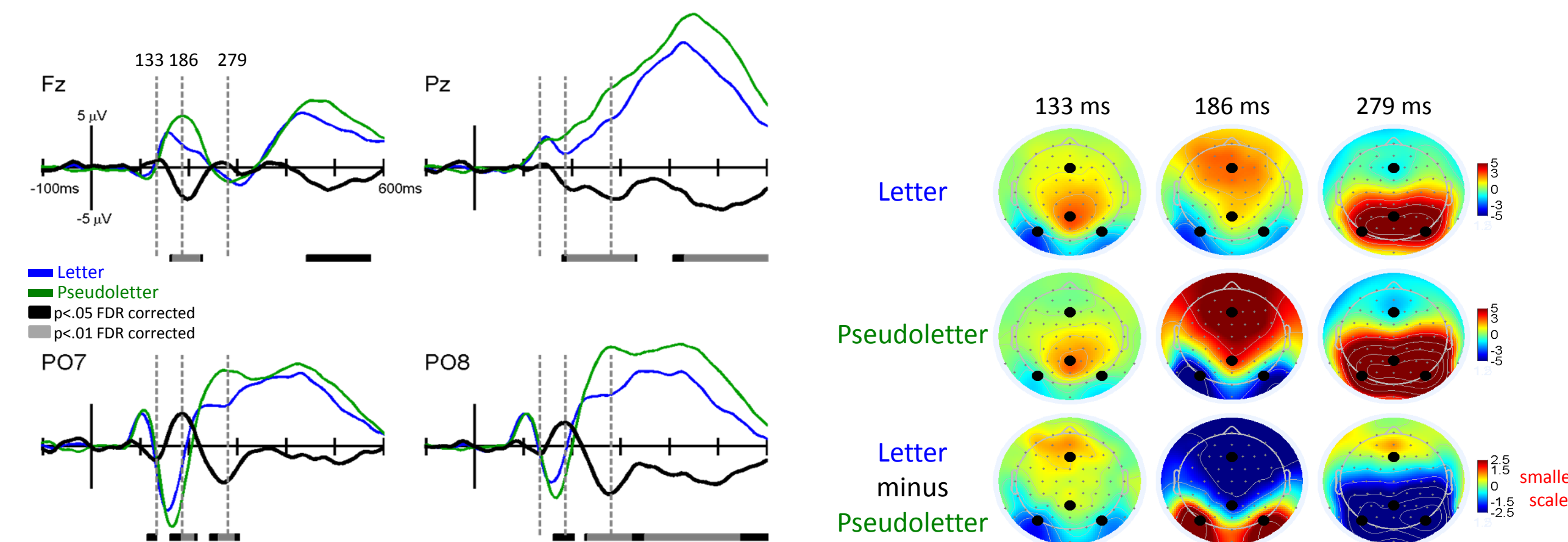
Rhyme Tasks (Note: Rhyme and NonRhyme ERPs were averaged across Rhyme and Paired-Rhyme tasks because they showed consistent effects)

- Greater negativities for NonRhyme than Rhyme at 145 ms and 426 ms^[11]



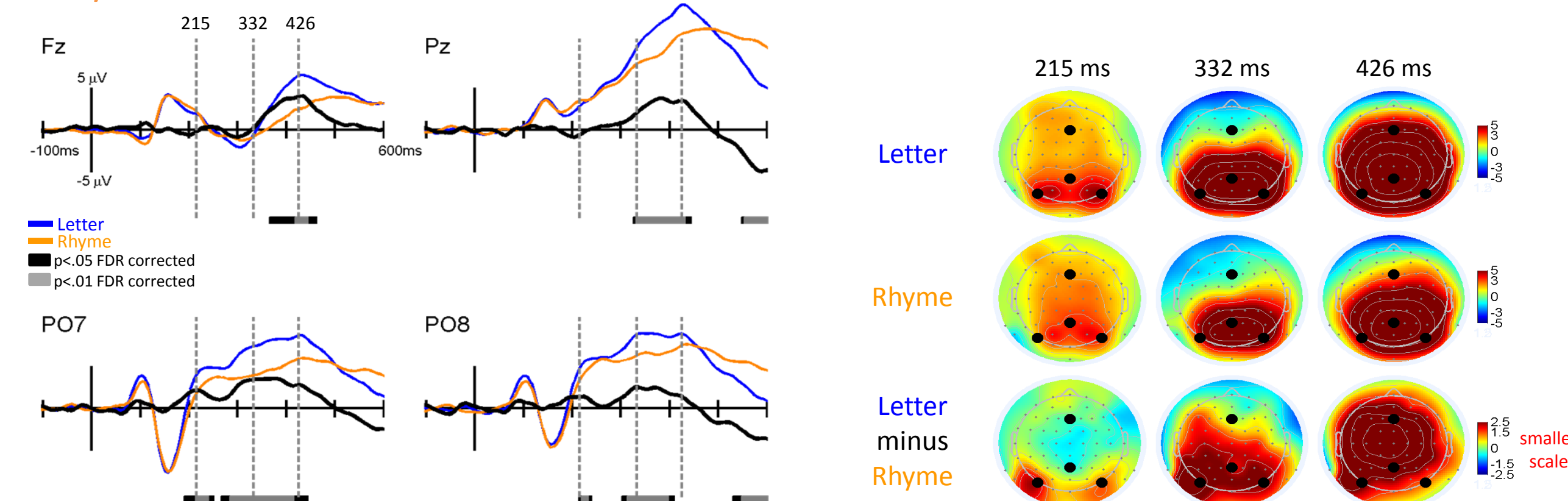
Letter ID Task

- Letter-Pseudoletter effect occurred at 130 ms
- N1 and P2 were larger and more delayed for Pseudoletters than Letters^[2,3]



Letter ID vs. Rhyme Tasks

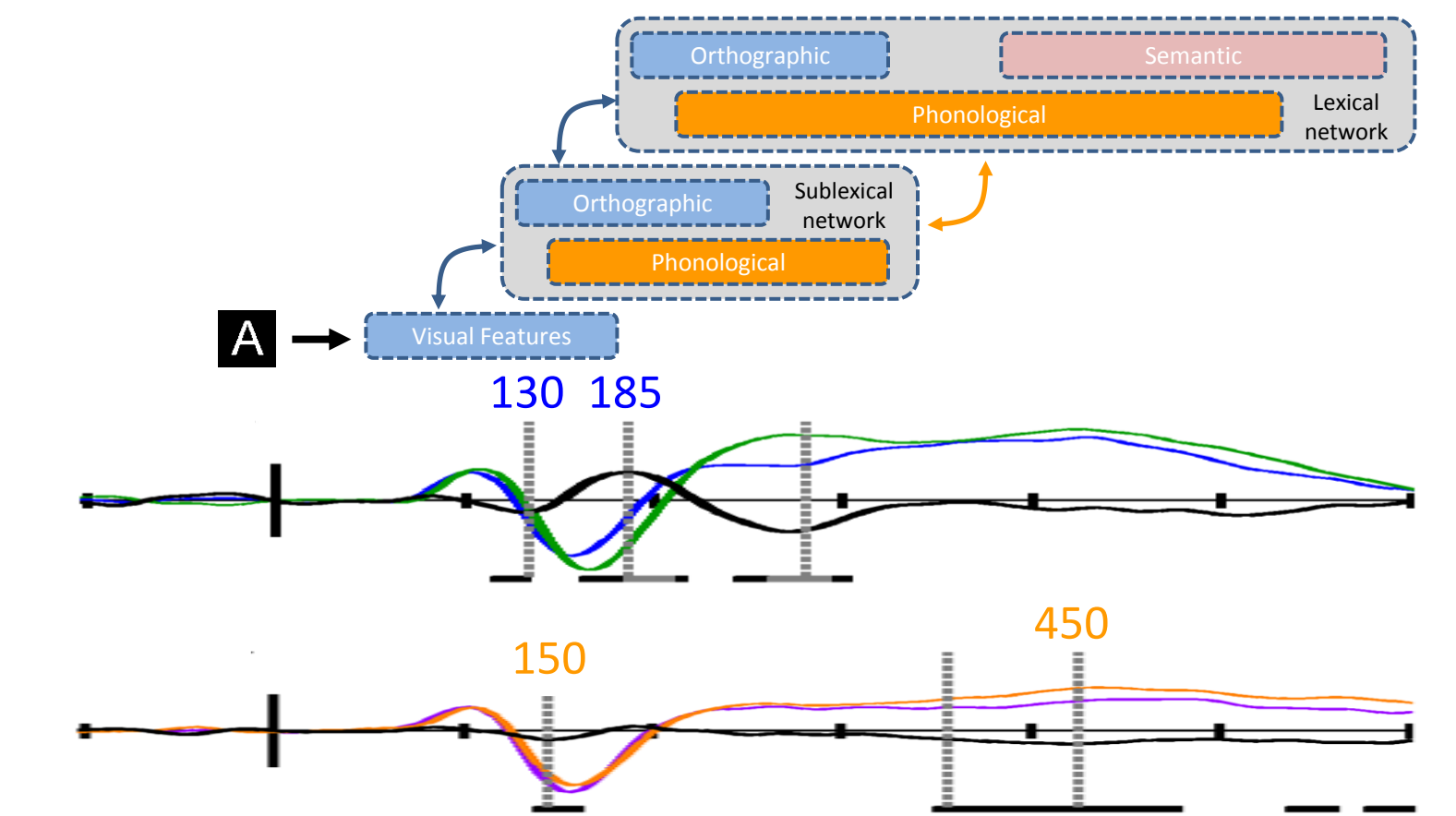
- Rhyme P2 < Letter P2^[2,10]



Summary

- Letter-Pseudoletter effect at 130 ms indicates early (or beginning stages of) sublexical orthographic processing
- Rhyme-NonRhyme effect at 150 indicates early (or beginning stages of) sublexical phonological processing
- Letter-Rhyme task effect at 200 ms indicates later sublexical phonological processing similar to that seen for lexical phonological processing^[2,10]
- We replicated N1 letter-pseudoletter effect^[2,4]
- We replicated N450 single-letter rhyme effect^[11]

Timing of Orthographic & Phonological Processing



Conclusion

Sublexical orthographic and phonological processing may begin as early as 130-150 ms with overlapping time courses that persist beyond 170 ms.

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