

Rethinking ERPs: Does sensory and linguistic experience shape ERP signatures in deaf signers?



Introduction

- Lifelong deafness & sign language use are associated with changes in visual attention, peripheral motion detection or face processing [1, 2, 3].
- It's unclear whether these experience-driven changes extend to core cognitive mechanisms indexed by canonical ERP components.
- Canonical ERP components (e.g., N170, N2pc, P3, LRP/ERN, N400) offer temporally precise markers of sensory, attentional, motor, and semantic processing. Few studies examined these components in deaf ASL signers using standardized tasks.
- **Goal:** Determine whether canonical ERP components are modality-neutral or shaped by language and sensory experience.

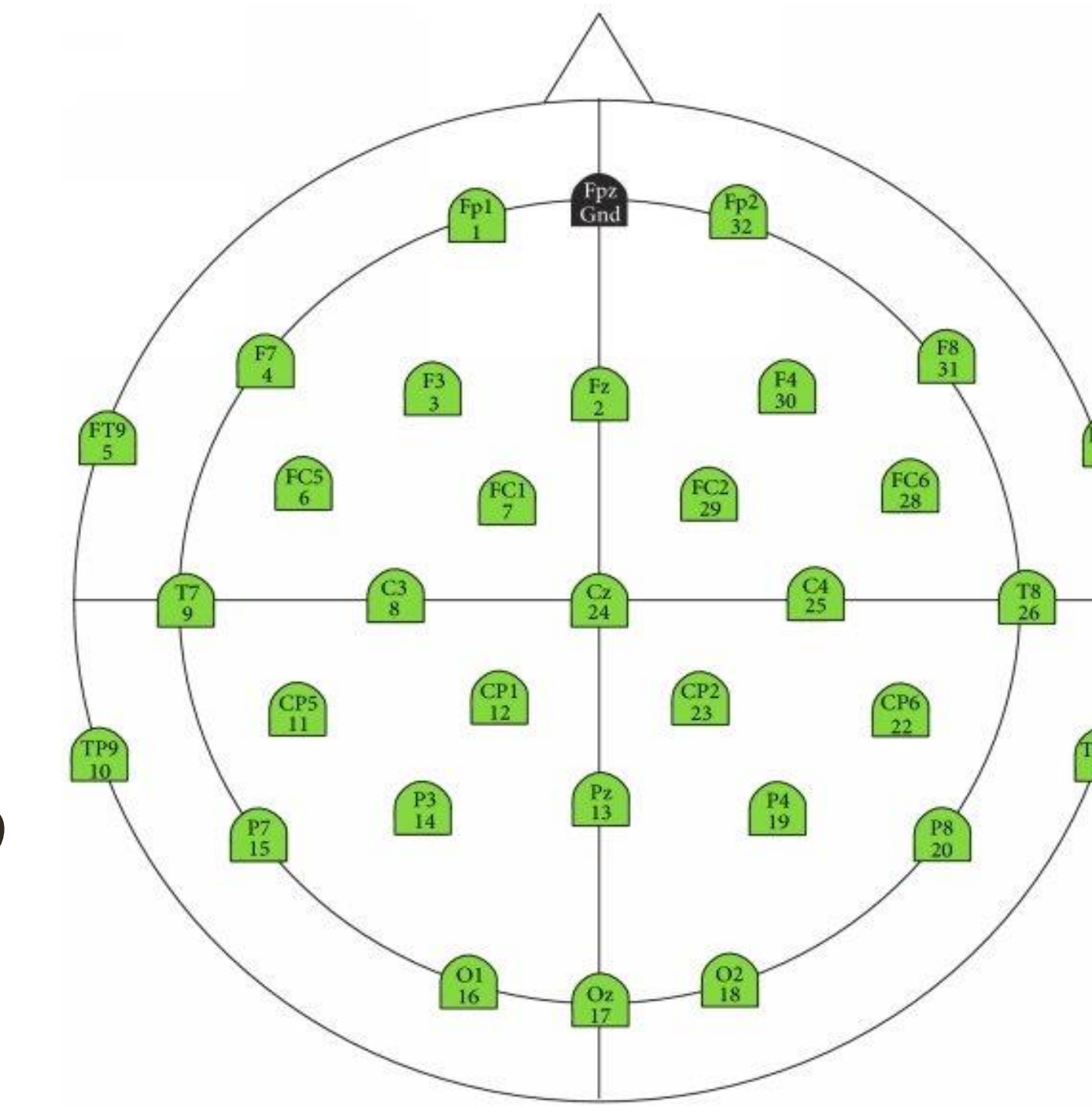
Methods

Participants

- 26 hearing non-signers (M_{age} = 30yrs; 5 men, 3 left-handed)
- 22 deaf ASL signers (M_{age} = 43yrs; 10 men, 1 left-handed)

EEG Recording

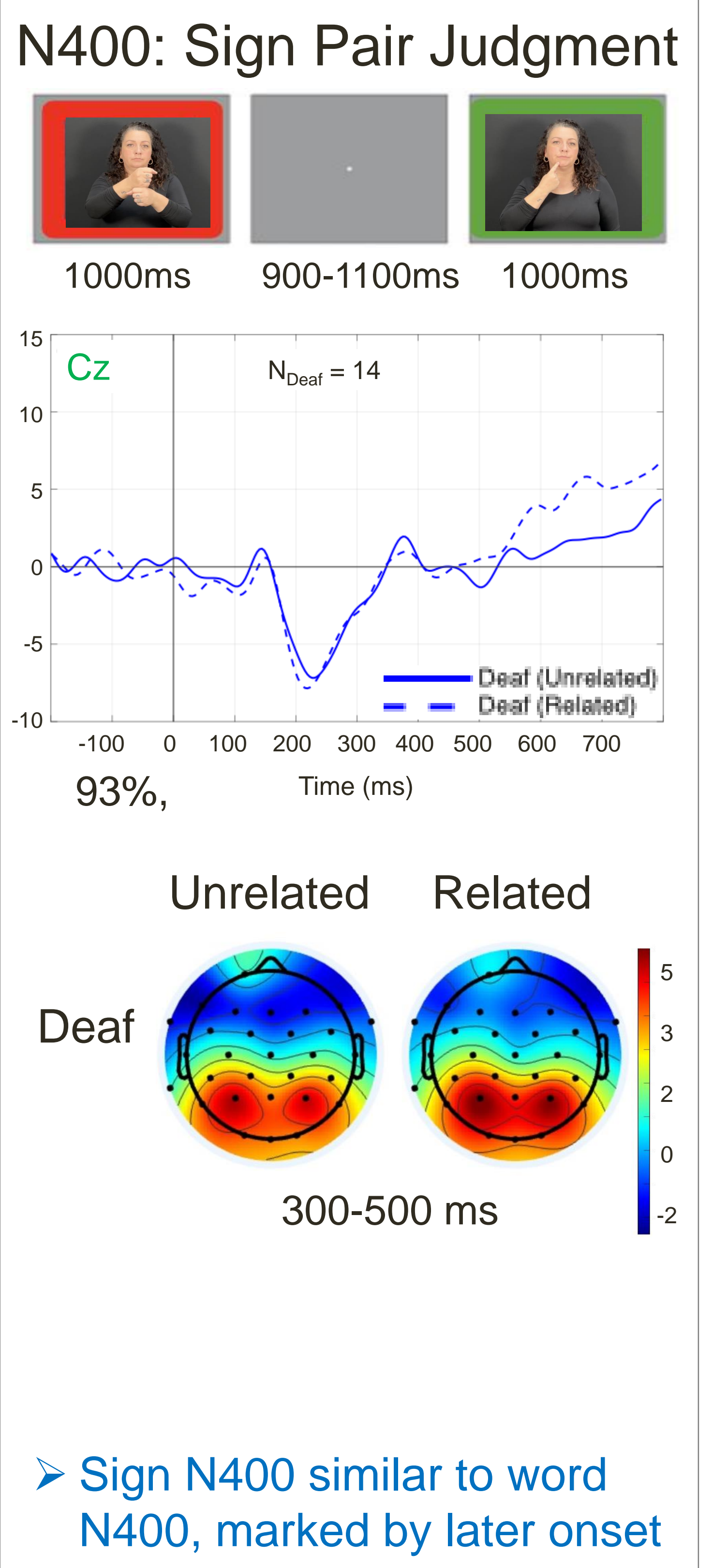
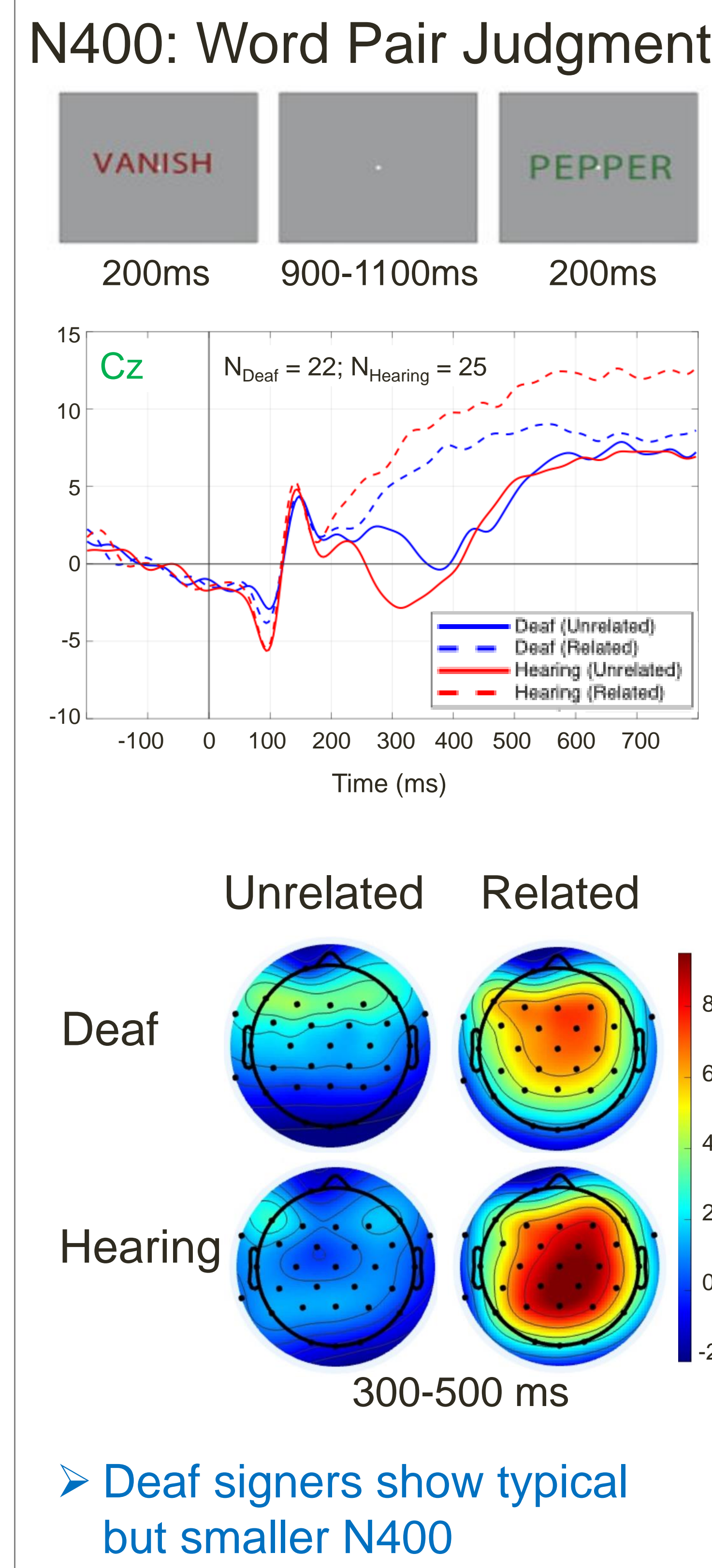
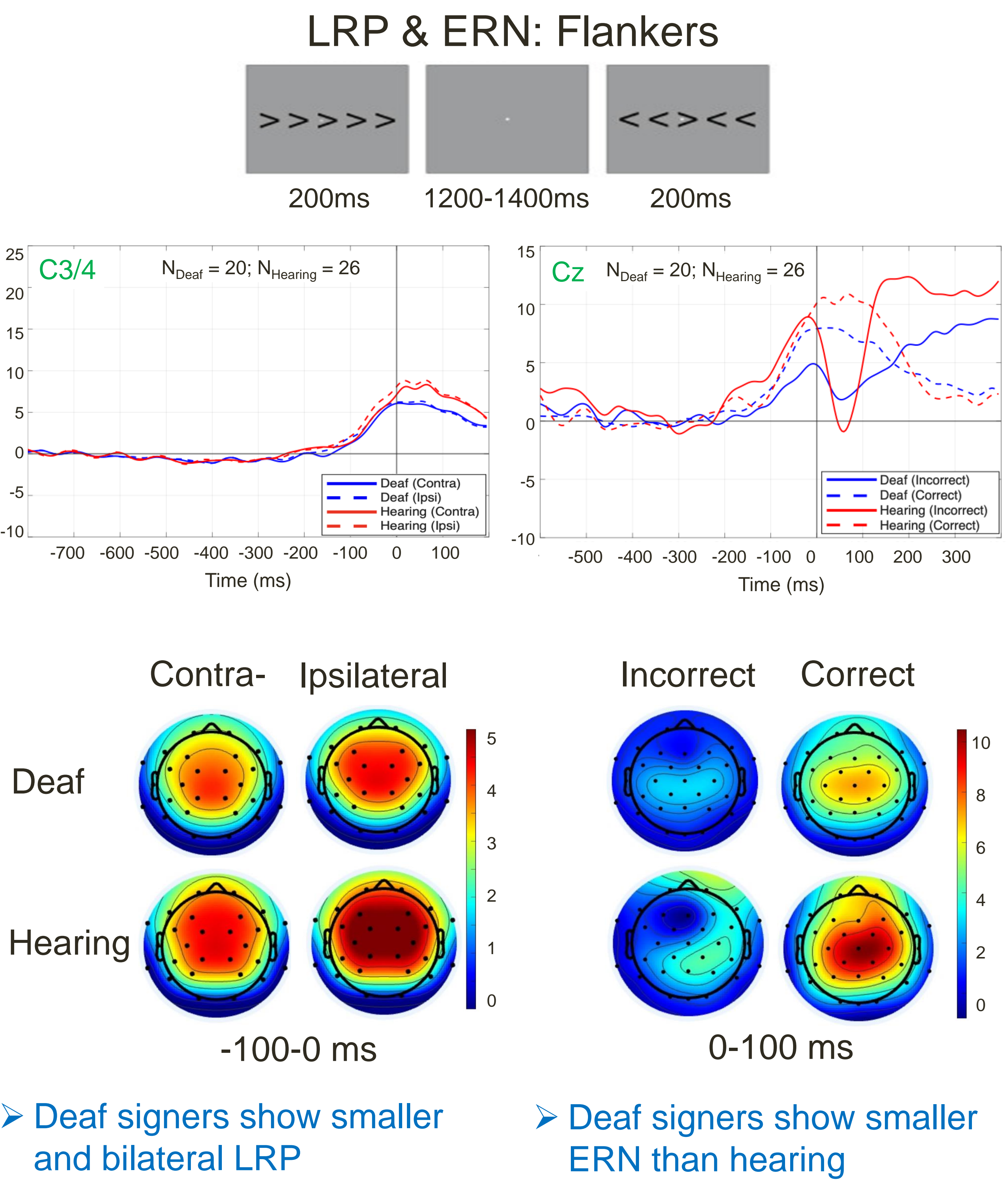
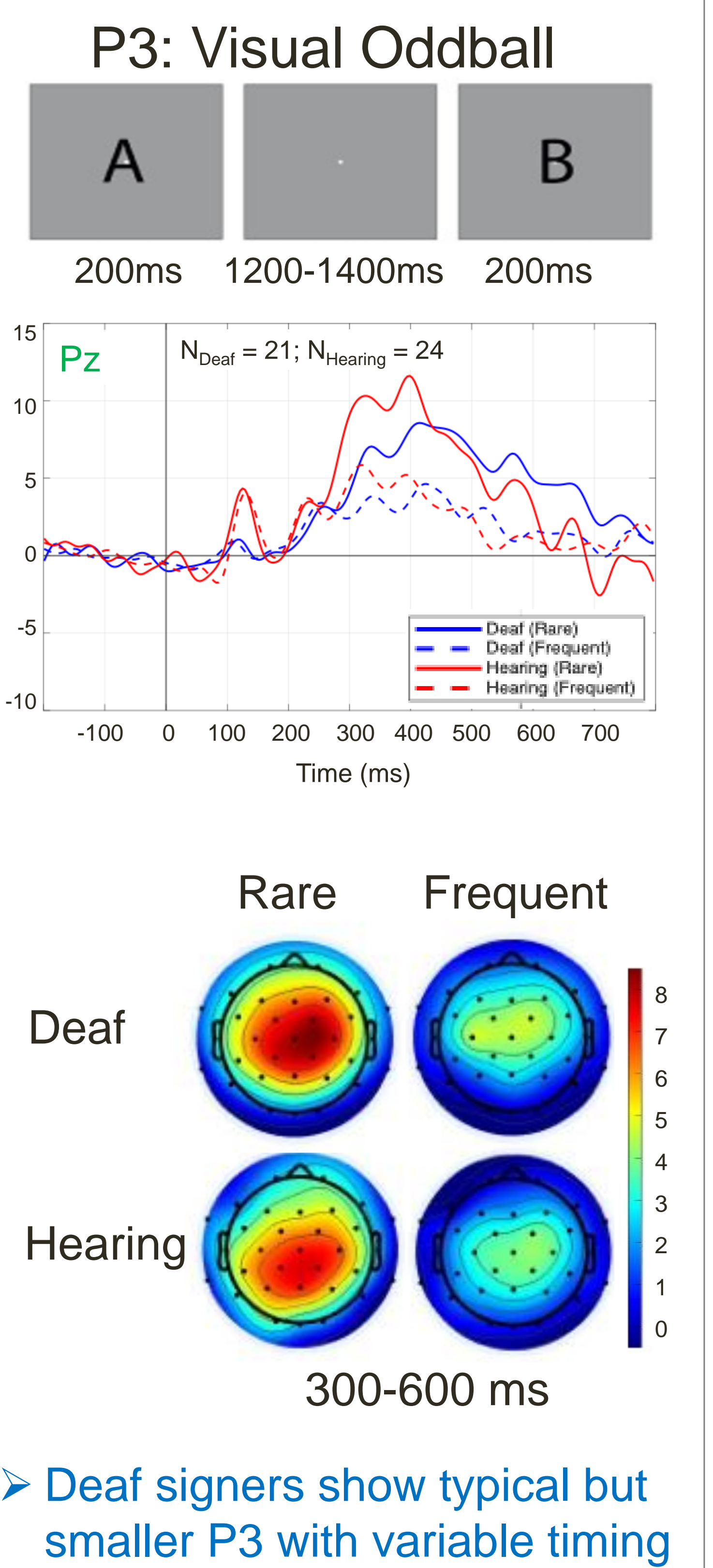
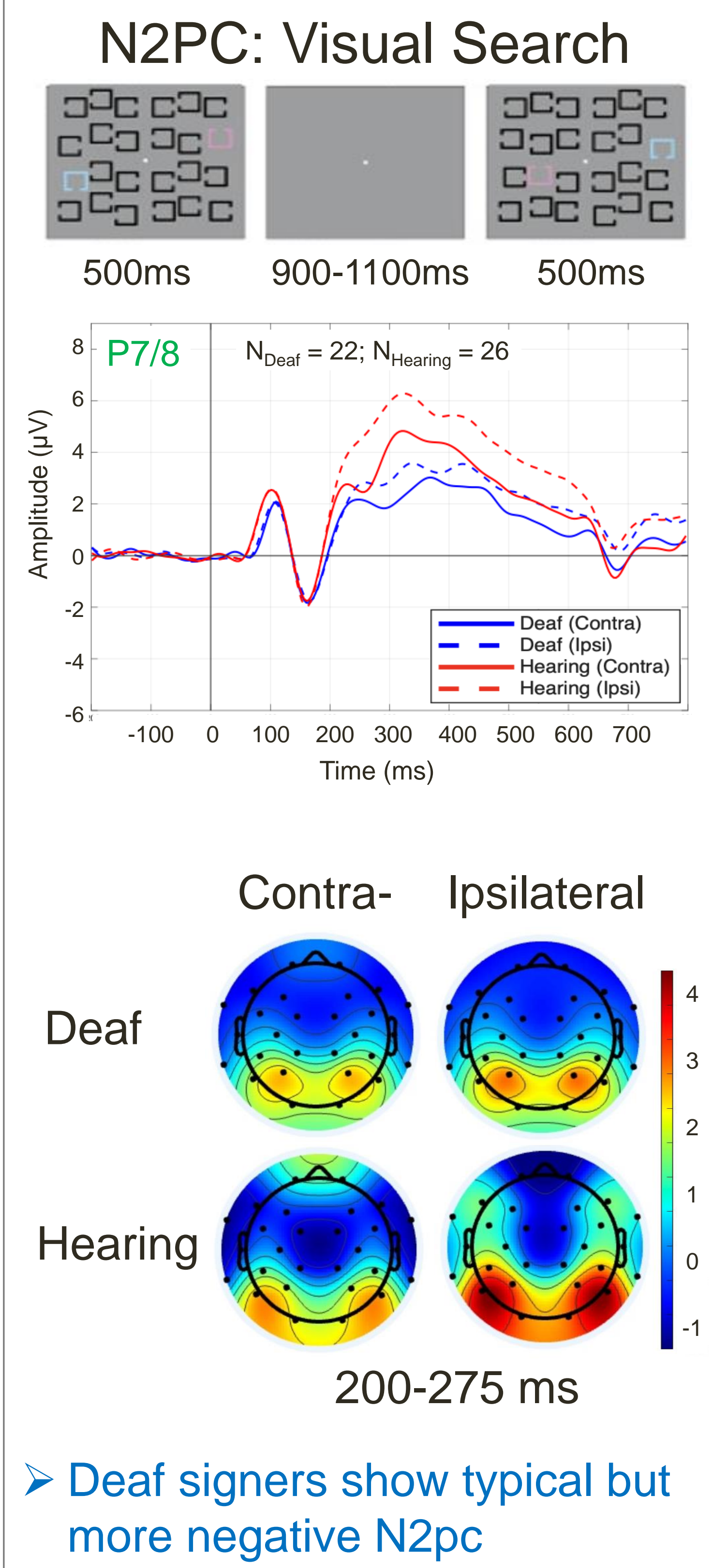
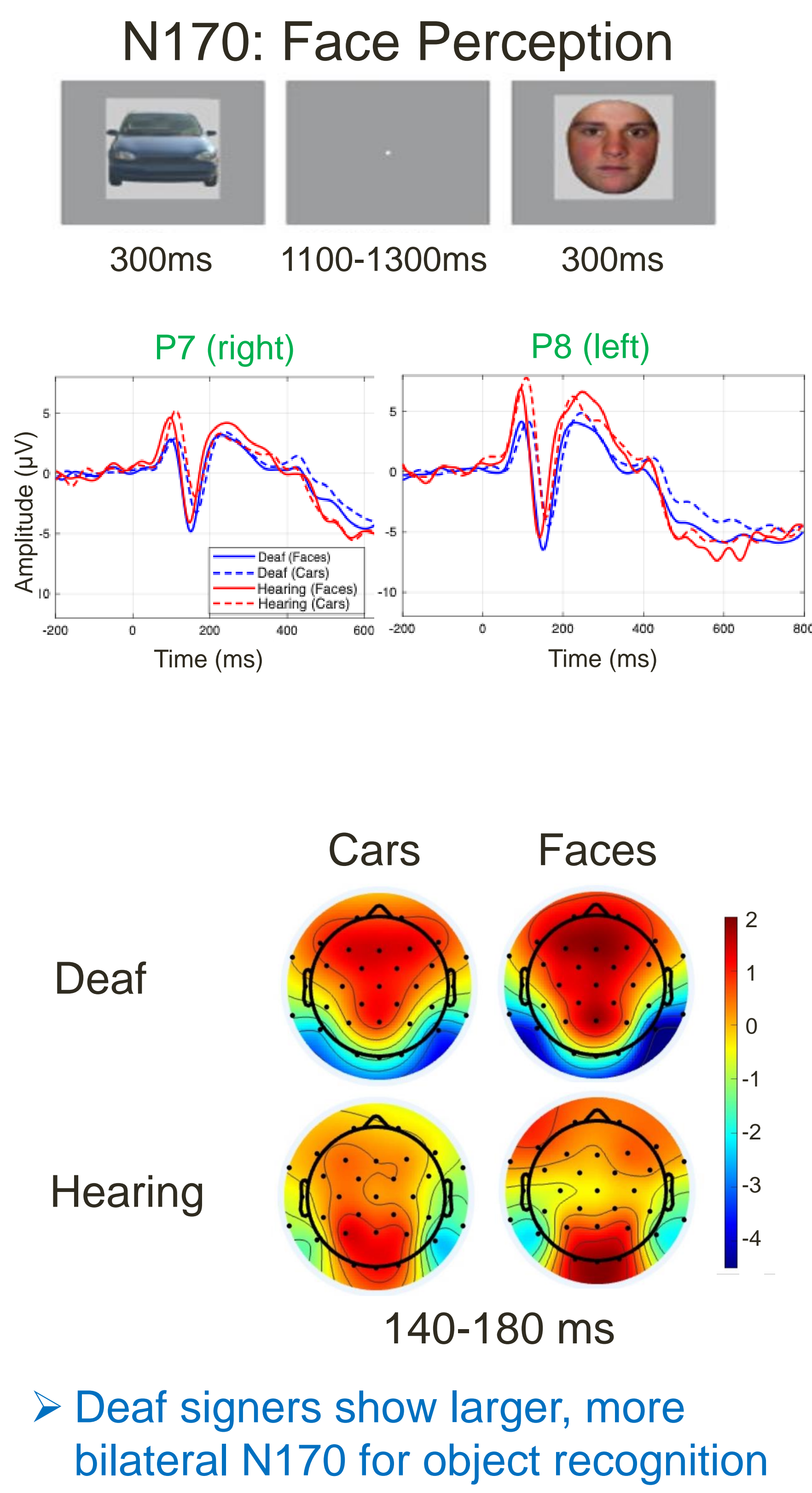
- Recorded with *BrainVision actiCHamp* over 32 scalp sites. Data analyzed in MATLAB (EEGLAB/ERPLAB toolbox).



Materials: ERP Core Task Battery [4]

Component	Task	Cognitive Process
N170	Face/Car Recognition	Face-specific processing, visual expertise
N2pc	Visual Search	Covert attentional selection
P3	Oddball Detection	Attention & working memory
LRP/ERN	Flankers	Motor preparation; Error monitoring
N400	Visual Word Pair, Sign Pair	Semantic integration

ERP Results



Behavioral results

Task	Group	Acc.	RT ms (SD)
Car Perception	Deaf	92%	460 (139)
	Hearing	91%	425 (111)
Face Perception	Deaf	93%	441 (127)
	Hearing	96%	397 (100)
Visual Search	Deaf	75%	587 (153)
	Hearing	93%	528 (111)
Visual Oddball	Deaf	93%	430 (152)
	Hearing	97%	380 (113)
Flankers	Deaf	84%	462 (138)
	Hearing	90%	390 (107)
Word Pair	Deaf	83%	704 (281)
	Hearing	97%	635 (232)
Sign Pair	Deaf	93%	1316 (303)

Discussion

- Canonical ERPs observed in both groups, with group differences in distribution, timing, and amplitude.
- **N170:** Deaf signers show bilateral tuning, suggesting reorganization of face processing pathways.
- **N2pc:** More negative in deaf signers, indicating heightened attention to peripheral visual targets (e.g., environmental monitoring effect).
- **P3:** Smaller, more variable timing in deaf group, suggesting reduced inhibitory control & broadly tuned attention & memory updating.
- **LRP (motor preparation):** Deaf signers show reduced amplitude, suggesting differences in motor preparation.
- **ERN (error monitoring):** Reduced in deaf group, possibly reflecting reliance on alternate error monitoring strategies in visuomotor tasks.
- **Word N400:** Robust in both groups; delayed and more posterior in deaf signers, suggesting distinct timing of semantic processing.
- **Sign N400:** Semantic priming in fluent deaf signers supports novel paradigm validity & cross-modal robustness of semantic integration.

References

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