

Introduction

- In a picture-sign matching task, Thompson et al. (2009)¹ and Vinson et al. (2015)² found that signers made faster decisions when an iconic property of the sign “aligned” with a salient feature of the picture than when the picture was not aligned with the target sign. For example, the iconic sign CAT in American Sign Language (ASL) depicts a cat’s whiskers and aligns with a picture of a cat with prominent whiskers, and this sign does not align with a picture of a cat from behind (see illustrations in Methods).

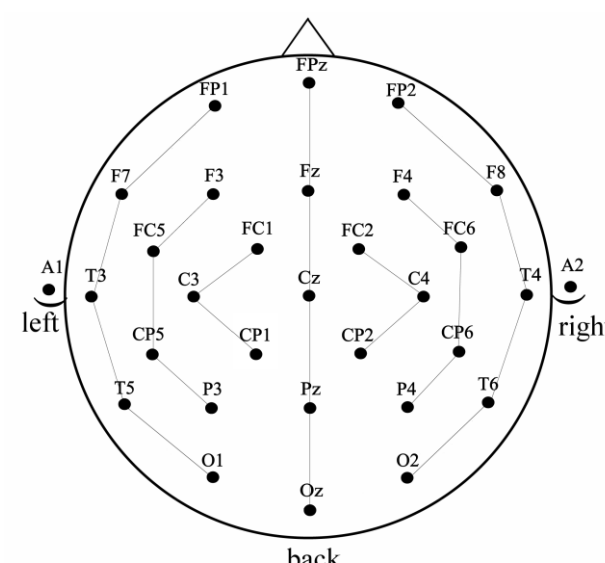
Present Study

- We capitalized on the temporal sensitivity of Event-Related Potentials (ERPs) to investigate whether the effects of iconic alignment observed by Thompson et al. (2009) occurred during lexical access (eliciting a reduced N400 response) or at the decision stage (eliciting a reduced P3 response). As in the Thompson et al. study, deaf ASL signers and hearing English speakers made matching decisions to picture primes and either target signs or audiovisual words.
- Relatedness Predictions:** Matching prime-target pairs should result in faster reaction times (RTs) and less negative-going N400 amplitudes than non-matching pairs for both ASL and English, demonstrating a typical semantic priming effect for both language modalities.
- Alignment Predictions:** Aligned picture-target pairs should result in faster RTs than nonaligned pairs only for signers (replicating Thompson et al., 2009).
- If the iconic alignment between the picture and the sign facilitates lexical access, then signs preceded by aligned pictures should exhibit a less negative N400 amplitude than signs preceded by non-aligned pictures. If picture-sign alignment instead impacts the matching decision, then we should expect effects on the P3 (which is tightly correlated with decision-making). These effects should not appear for hearing non-signers performing the task with spoken English targets.

Methods

Participants:

- Signers: 24 Deaf Native/Early signers
 - Mean age = 34
 - 12 early, 12 native
- Hearing speakers: 24 hearing native English speakers
 - Mean age = 29



Picture-Sign/Word Matching Task:

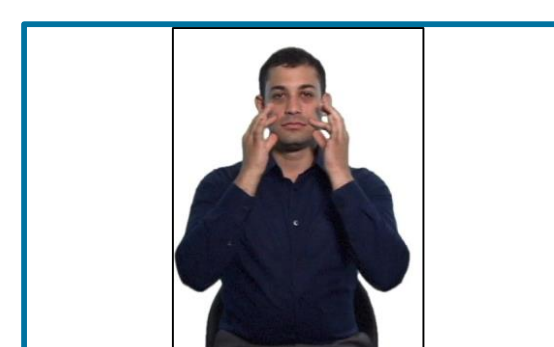
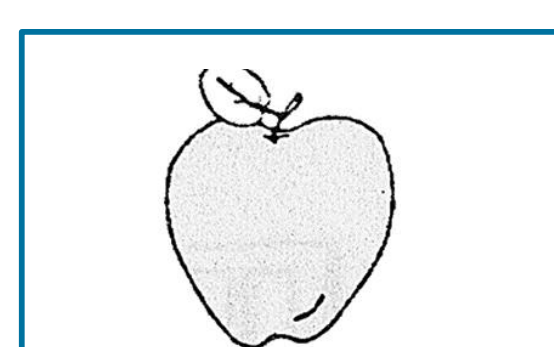
- Picture-prime followed by target-sign/word video
 - Pictures were 360 black and white line drawings
 - A native hearing signer was recorded producing the ASL signs and the English words. Sign videos were clipped to 100ms before sign onset, and English videos to 300ms before speech onset
 - ERPs were time-locked to sign/speech onset
- Participants pressed one button on the gamepad to indicate a matching pair, and another to indicate a non-matching pair
 - Reaction times were calculated as time elapsed between sign/word onset and button press

Stimuli:

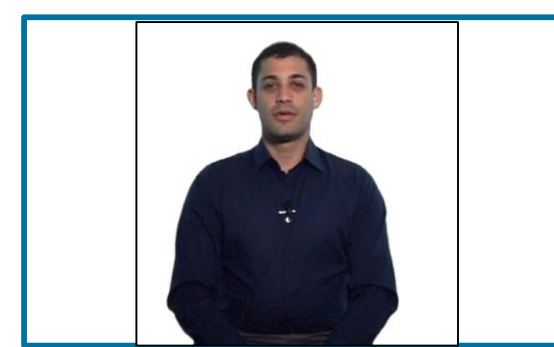
Two conditions

- Relatedness:** The targets were either unrelated, or names for the picture. Half of trials were related, and half were unrelated.
- Alignment (within the matching condition):** For the 120 critical trials, the picture was either visually aligned or nonaligned to the target video.

Non-matching



OR



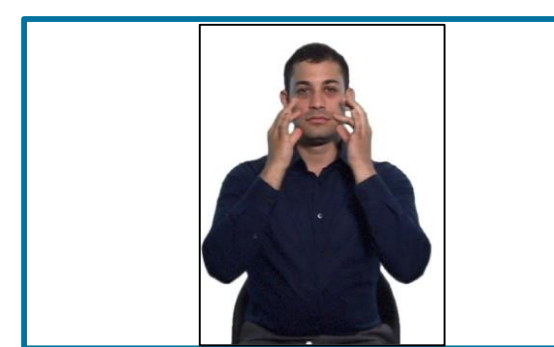
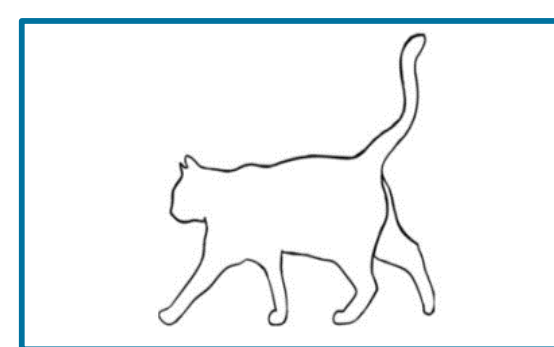
“Cat”

The prime-picture and the target-sign/word do not match.

The participant presses the button corresponding to ‘no’.

Matching

Nonaligned

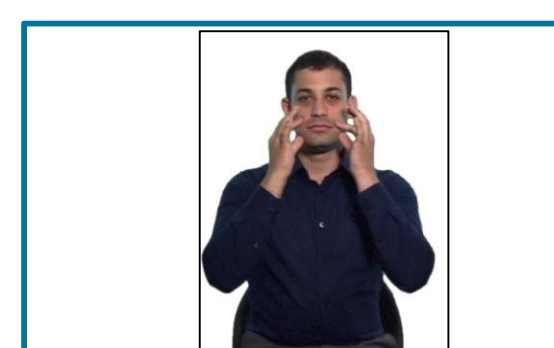
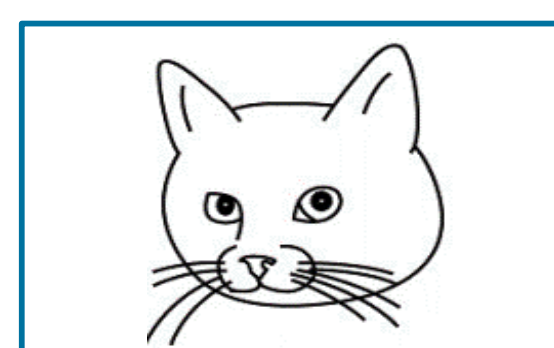


CAT

The prime-picture and the target-sign/word do match.

The participant presses ‘yes’.

Aligned



CAT

There is structured overlap between the prime and target sign in the aligned trials.

Relatedness Results

Behavioral Results

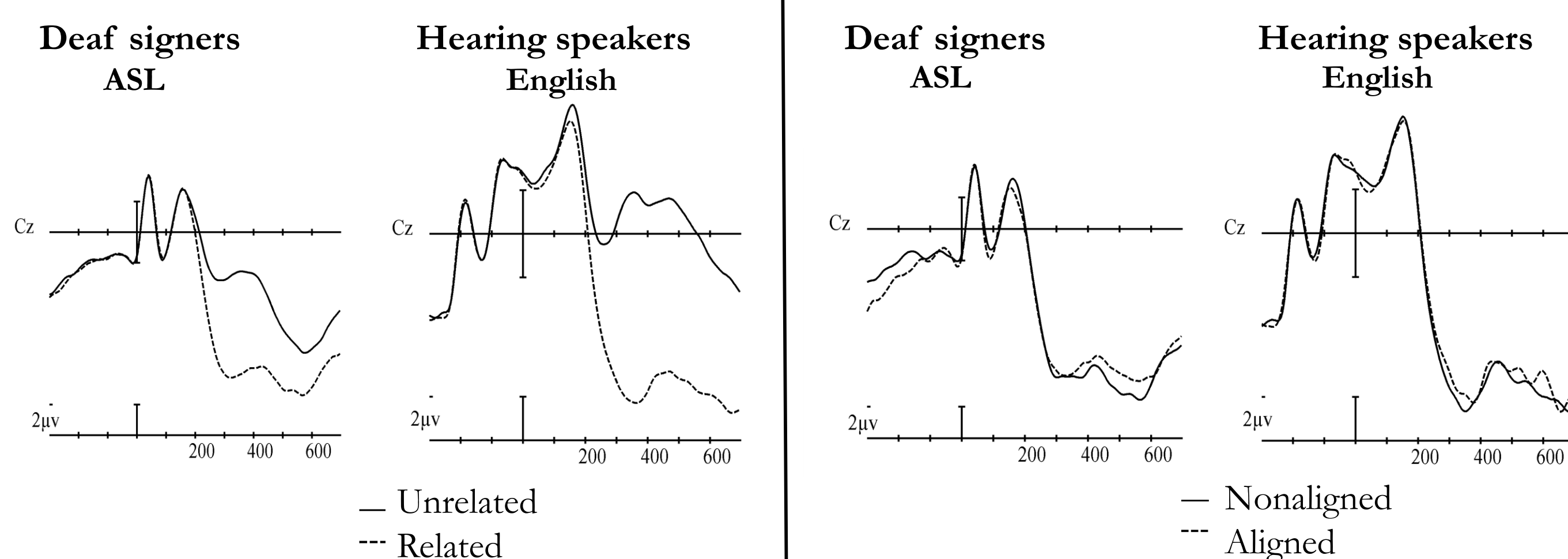
	Deaf signers ASL		Hearing speakers English		Alignment Results			
	Related M(SD)	Unrelated M(SD)	Related M(SD)	Unrelated M(SD)	Deaf signers ASL		Hearing speakers English	
	Aligned M(SD)	Nonaligned M(SD)	Aligned M(SD)	Nonaligned M(SD)	Aligned M(SD)	Nonaligned M(SD)	Aligned M(SD)	Nonaligned M(SD)
Average RTs(ms)	769 (123)	835 (132)	786 (152)	865 (134)	745 (119)	759 (118)	778 (149)	786 (154)
	p=.037* diff. = 66ms		p=.048* diff. = 79ms		p=.339 diff. = 14ms		p=.436 diff. = 8ms	

ERP Components

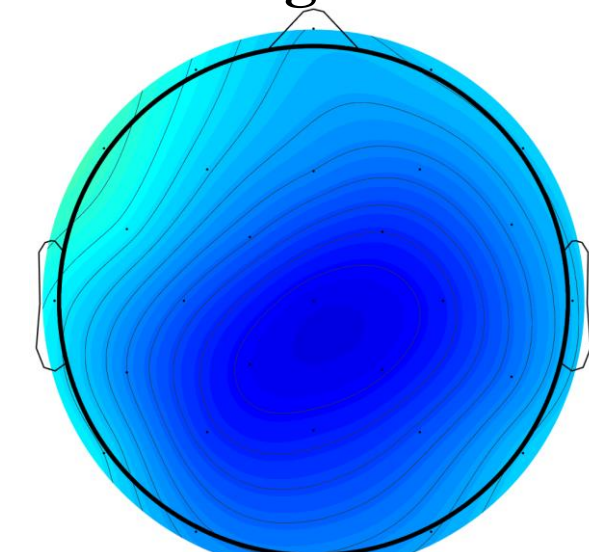
N400: A negative-going wave that typically onsets around 300ms after presentation of a word or sign. The N400 is sensitive to lexical and semantic processing³. Smaller amplitude N400s are generally associated with less effortful lexico-semantic processing.

P3: The P3 component is a positive-going wave elicited in the process of decision making³. A more probable stimulus results in a less positive-going wave.

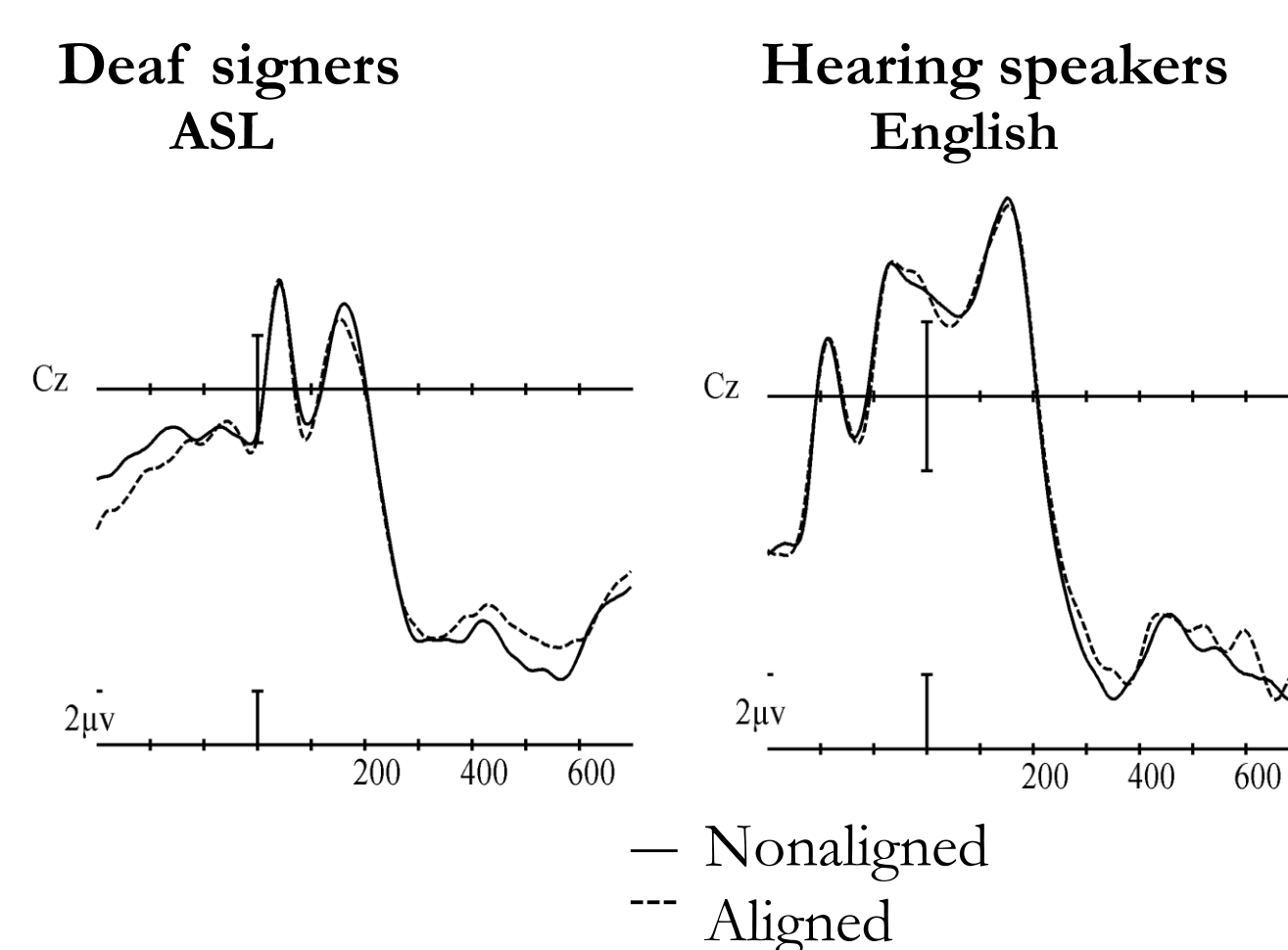
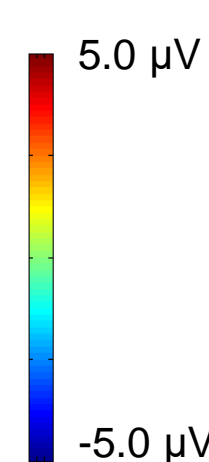
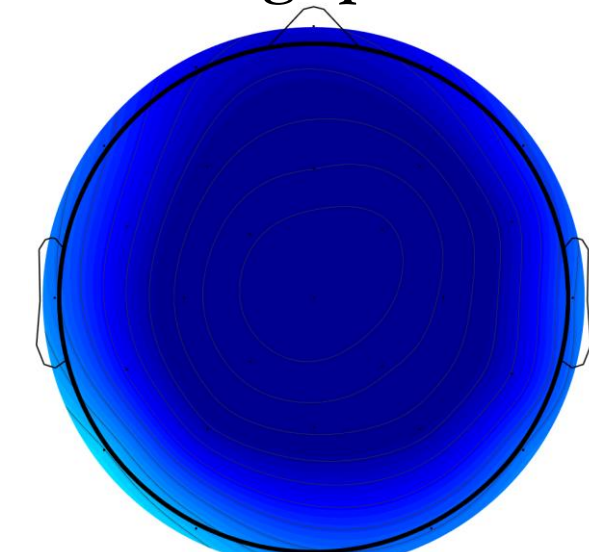
Electrophysiological Results



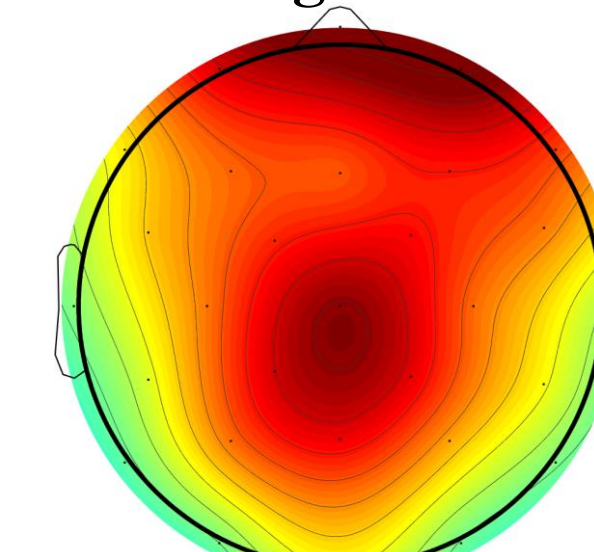
400-600ms
Deaf signers: ASL



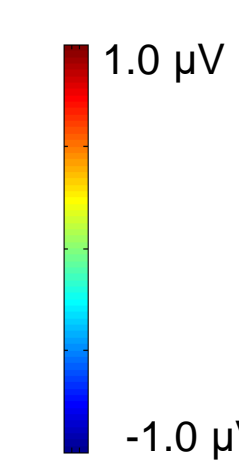
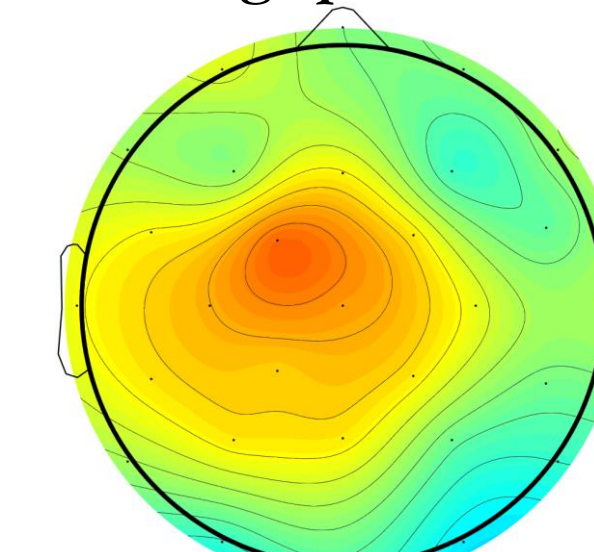
Hearing speakers: English



400-600ms
Deaf signers: ASL



Hearing speakers: English



- Related targets (“yes” responses) elicited a large wide-spread priming effect (decreased negativity) compared to unrelated targets (“no” responses).
- This pattern indicates a strong semantic priming effect across the N400 epoch for both ASL signers and English speakers, consistent with our predictions.

- For ASL, aligned target signs showed reduced positivity compared to non-aligned target signs on the P3 component.
- Little evidence of an N400 effect for aligned vs. non-aligned target signs.
- No significant differences on the P3 component between target words in the aligned and non-aligned conditions for English speakers.

Conclusions

- Relatedness:** Regardless of language modality, participants showed very similar effects of semantic priming. Matching (related) targets were associated with reduced negativity during the N400 epoch and elicited faster response times than non-matching (unrelated) targets.

- Alignment:** We observed no effects of alignment for English speakers.
- For deaf signers, alignment between picture and sign did not result in reduced N400 amplitude. However, picture-sign alignment did result in a significant modulation of the P3 component. As the P3 is associated with decision-making our results suggest that alignment impacts decision processing rather than lexical-semantic processing.

References

- Thompson, R., Vinson, D., & Vigliocco, G. (2009). The link between form and meaning in American Sign Language: Lexical processing effects. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35(2), 550–557.
- Vinson, D., Thompson, R. L., Skinner, R., & Vigliocco, G. (2015). A faster path between meaning and form? Iconicity facilitates sign recognition and production in British Sign Language. *Journal of Memory and Language*, 82, 56–85.
- Luck, S. J. (2014). *An introduction to the event-related potential technique*. MIT press.