Brain-based individual difference measures of reading skill in deaf adults

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Introduction

How do we teach children to read?
• Usually based on the sounds of language

What if those children are deaf?
Reading can be difficult for many (but not all) deaf individuals:
• 60% of deaf high school graduates read at or below a 4th grade reading level1
• But: 10% read above an 8th grade level

Why? There is disagreement2, The reasons matter for determining the best educational strategies and language environments for deaf children.
Our goal: Use real-time measures of language processing (ERPs) to understand how some deaf individuals read more proficiently than others.

Specifically:
1) Do deaf and hearing individuals read proficiently using the same language processing mechanisms? 2) Do deaf individuals from different language backgrounds (spoken vs. signed) read proficiently using the same language processing mechanisms?

Methods

Participants: Severely/profoundly prelingually (<2 years of age) deaf adults (n=40), Age-matched hearing controls (n=22)
Procedure: Visual word-by-word presentation of stimuli, continuous EEG recorded from 19 scalp electrodes (10-20 system)
Sentence Violations (30 sentences per condition)

Results

1. Participant characteristics

2. Syntactic (agreement) violations in sentences

3. Semantic violations in sentences

4. What predicts better reading skill – responses to syntax or semantics?

5. Double semantic and agreement violations

Conclusion

The best deaf readers have larger N400s to semantic and combined semantic+syntactic sentence violations.

This suggests that the best deaf readers focus more on meaning than grammar.
• Plausible: The “good enough” parsing strategy3

Hearing readers appear to be different. The best hearing readers seem to have the largest responses to grammatical violations.

This suggests teaching strategies that can be tested with deaf children. Focusing more on vocabulary and relationships between words rather than 100% precise grammatical parsing.

Also: Proof of concept that individual ERP responses can predict reading comprehension in highly variable populations. The variation is systematic.

Future Directions

Final sample size:
• 45 deaf participants
• 45 hearing participants

Final analysis:
• Multiple regression to find best predictors of:
  • Better reading skill
  • Larger ERP responses
• Include both groups in the same model

Future projects: Similar research in deaf children, in homogenous language groups...

References


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