

Investigating the Role of Phonological Awareness on Reading in Deaf Native Signers

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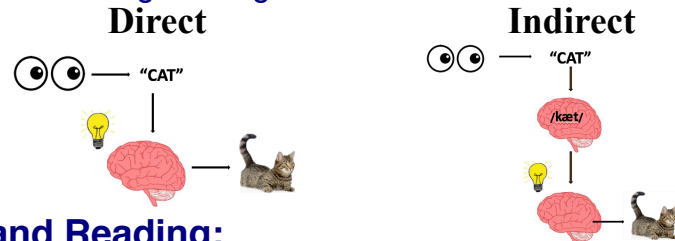
Background:

Issues in Deaf Literacy and a theory of reading:

- Deaf adults have a reading level of 4th grade (9th grade among hearing adults)¹
- Phonological Awareness**— Metalinguistic knowledge of basic units of language and the ability to segment and manipulate incoming language signals.
- Pre-reading phonological awareness skill is the strongest predictor of reading fluency for hearing children² but only weakly predictive, if at all, in deaf readers^{3,4}
- General language skill has been shown to be most predictive of advanced reading skill in native deaf signers⁵
- Developmental Bypass Theory

Phonological Recoding:

- The process of directly mapping individual written letters to their corresponding speech sound when reading.
- Direct** (whole-word sight reading) vs. **Indirect** (phonological recoding) route of meaning activation during reading⁶



Eye-tracking and Reading:

- Clear, non-invasive measure of cognitive mechanisms underlying behavior.
- Analyze error detection via number of fixations, number of regressive eye-movements, and total reading time for a region⁷.
- Native deaf signers have been shown to be more **efficient** readers, demonstrating overall faster reading times and fewer fixations and regressions than hearing⁸.

Research Questions:

- Do deaf readers perform phonological recoding while reading?
- Do deaf and hearing readers demonstrate different strategies and patterns of error detection while reading?
- Do deaf and hearing readers vary in *reading efficiency*, as measured by number of regressions, fixations, and reading time?

Methods:

Participants: 12 native deaf signers (ages 10-13; 8 females) and 17 hearing controls (ages 10;2-13; 6 females).

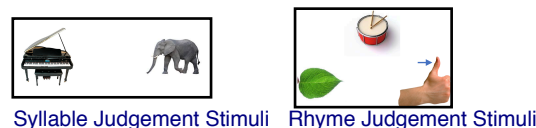
- Deaf participants are native signers from Deaf families and attend the bimodal bilingual Texas School for the Deaf. Hearing participants are monolingual English speakers with no hearing loss or language disorder.
- All participants have at least one parent with a college degree.

Independent measure of reading:

- Woodcock-Johnson (WJ)-III Test of Silent Reading Fluency

Measures of Phonological Awareness:

- English Phonology⁹
 - Picture-based rhyme judgement
 - Picture-based syllable judgement
- American Sign Language Phonology
 - ASL-PA¹⁰
 - ASL Similarity Judgement Task



Eye-tracking paradigm¹¹- Passive reading task on an EyeLink 1000

- Correct:** I peered out the window to **see** if you were home.
- Homophone Foil:** I peered out the window to **sea** if you were home.
- Spelling Control:** I peered out the window to **set** if you were home.

If Correct and Homophone foil conditions are read similarly:

- Evidence that English phonology is active during reading because the homophone error is not detected in context.
- Support for the *indirect route* of meaning activation

If Spelling and Homophone foil conditions are read similarly:

- Evidence that English phonology is *not* active during reading because the homophone error is detected.
- Support for the *direct route* of meaning activation.

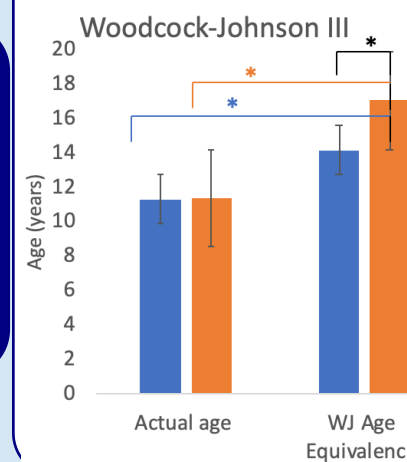
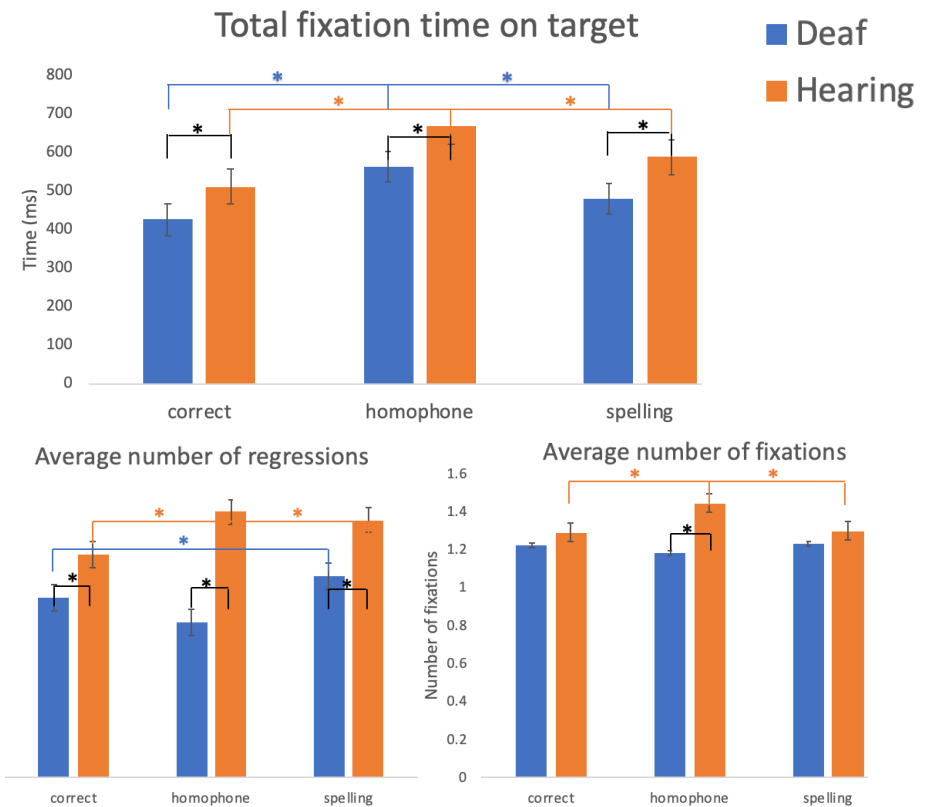
Predictions:

- Deaf and hearing readers with more advanced reading skill will detect errors.²
- Deaf readers will demonstrate efficient reading strategies.⁸
- Deaf readers will not demonstrate English phonological activation during reading.⁵
- Deaf native signers will demonstrate reading skill beyond expectations.⁵

Results:

Region containing the target word analyzed via:

- Total looking time**- cumulative looking time across all fixations
- Number of fixations**- total fixations in target exceeding 150 ms.
- Regressions**- average number of regressions back into target region



Generalized linear mixed models:

- Phonological awareness do not account for the variability between deaf and hearing participants, with the exception of *syllable awareness* score on regressions.
- WJ-III scores significantly predict number of fixations ($p = 0.0026$) and total reading time ($p < 0.001$).
- All measures have a significant effect of hearing status.

Interpreting the results:

Evidence Supporting Phonological Recoding in Deaf Signers

- Fewer fixations & regressions with homophone foil.
- Syllable awareness significantly predicts number of regressions performed by deaf readers in the homophone foil condition.

Evidence Against Phonological Recoding in Deaf Signers

- Increased total fixation time on homophone foil as compared to correct target.
- ASL and English phonological awareness do not seem to drive a lot of the variation in reading measures between deaf and hearing participants.

Discussion:

- Deaf participants read significantly more *efficiently*: they perform fewer fixations and regressions, overall less total reading time⁸
- Deaf readers with higher ready fluency scores (WJ-III) demonstrate more advanced, skilled reading strategies.
- Orthographic knowledge* and spelling skill are not specifically addressed in this study, but they could be driving the differences we see in error detection across the two experimental conditions.

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