

## Introduction

- Children with developmental language disorder (DLD) have difficulty learning words implicitly (without direct definition or instruction)<sup>1</sup>
- Behavioral measures measure the outcome of word learning
  - It is unclear how confident one needs to be to explicitly indicate a word's meaning
- Electroencephalography (EEG) accesses subconscious lexical processing without needing an explicit response
- By examining subjective confidence ratings we can better understand how children with and without DLD perceive implicit language learning

### Research Question:

Does confidence level inform neural representations of implicitly-learned nonsense words for school-aged children with DLD and their typically developing (TD) peers?

## Methods

### Behavioral Measures:

- Nonverbal cognition: Wechsler Intelligence Scale for Children 5th Edition
- Receptive vocabulary: Peabody Picture Vocabulary Test 4th Edition
- Expressive vocabulary: Expressive Vocabulary Test 2nd Edition
- Semantics and syntax: Clinical Evaluation of Language Fundamentals 4th Edition
- Phonological working memory: Nonword Repetition Task<sup>2</sup>

### Word Learning Task:

- 50 sentence triplets ending in the same novel word, a target noun
- Example triplet:

- (1) *Her parents bought her a pav.*  
(2) *The sick child spent the day in his pav.*  
(3) *Mom piled the pillows on the pav.*

### Confidence Rating:

- Directly followed each sentence triplet, the participants were asked to indicate how confident they were that they provided the correct response:

**1 = low confidence, 2 = medium confidence, 3 = high confidence**

### EEG analysis:

- N400 event-related potential (ERP) component, indexes semantic processing
- Electrodes<sup>3</sup>: F3, Fz, F4, C3, Cz, C4, P3, Pz, P4
- Timing: 300-500 msec post-target word onset

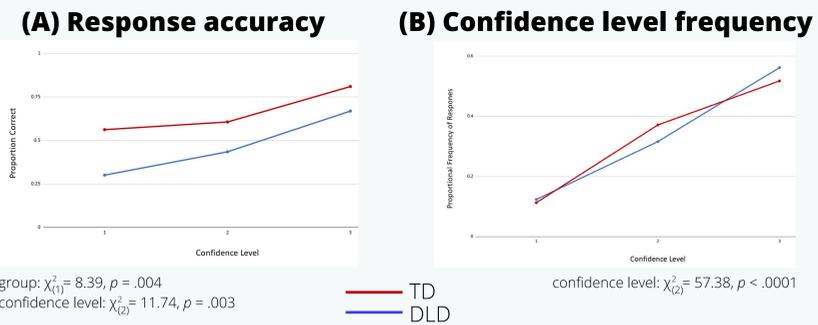
## Fig. 1: Participants

All Participants		<ul style="list-style-type: none"> <li>• Monolingual</li> <li>• Right-handed</li> <li>• Aged 8-13</li> <li>• Normal hearing</li> <li>• No history of neurologic disorders</li> </ul>
DLD N=13	<b>Qualifier</b> <ul style="list-style-type: none"> <li>• Normal Cognition</li> <li>• Low Language</li> <li>• Low Vocabulary</li> </ul>	<b>Assessment (Mean)</b> <ul style="list-style-type: none"> <li>• WISC &gt; 70 (88.3)</li> <li>• CELF &gt; 85 (73.7)**</li> <li>• PPVT (94.9)*; EVT (89.9)**</li> <li>• NWR (82.9%)*</li> </ul>
TD N=13	<b>Qualifier</b> <ul style="list-style-type: none"> <li>• Normal Cognition</li> <li>• Normal Language</li> <li>• Normal Vocabulary</li> </ul>	<b>Assessment (Mean)</b> <ul style="list-style-type: none"> <li>• WISC &gt; 70 (93.4)</li> <li>• CELF &gt; 85 (100.5)</li> <li>• PPVT (106.8); EVT (101.9)</li> <li>• NWR (92.5%)</li> </ul>

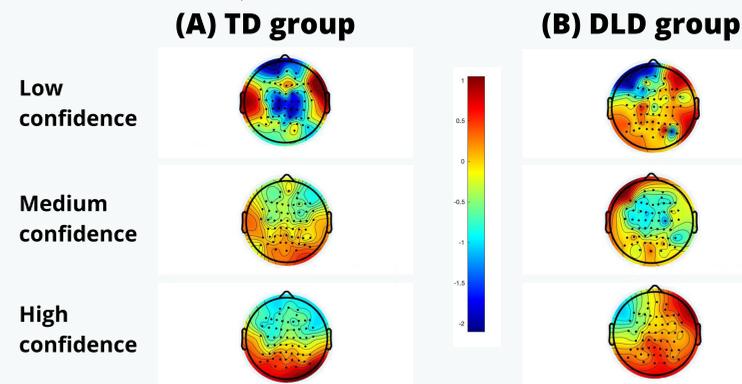
\*p < .05; \*\*p < .001

## Results

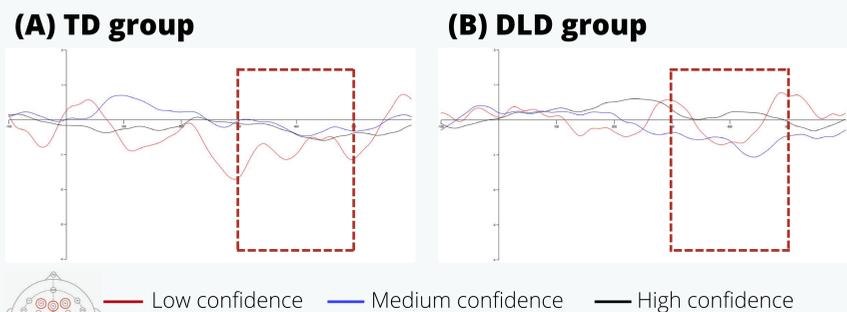
**Fig. 2: Behavioral performance.** Performance on the Word Learning Task examined through (A) response accuracy and (B) frequency of each confidence level response.



**Fig. 3: ERP voltage maps.** N400 effects for 300-500 msec post-target word onset in the final sentence in each triplet.



**Fig. 4: ERP waveforms.** N400 effects for the target word in the final sentence in each triplet by confidence level.



**Fig. 5: N400 effect at widespread sites.** Line graph showing significant group x confidence level interaction.

## Findings

- DLD group performed significantly worse on the word learning task across confidence levels
- DLD group and TD group did not differ in confidence ratings
- Voltage maps revealed different patterns of effort allocation
  - More effortful semantic processing for DLD participants although they had poorer word learning outcomes
- N400 findings:
  - The DLD group showed the greatest difference in the effort involved in semantic processing between medium and high confidence, whereas the TD group did not differ across confidence levels

## Conclusions

- This study strengthens the hypothesis that children with DLD have difficulty with incidental word learning
- Behavioral findings show that children with DLD are similarly confident in their word learning success compared to TD children but with poorer word learning outcomes, suggesting overconfidence
- EEG findings support this overconfidence in DLD: when children with DLD have high confidence, they had less effortful semantic processing but accuracy is still lower

**Clinical takeaway:** If a child with DLD claims to know the meaning of a word, they still may require additional exposures to fully map meaning

## References & Funding

### References:

1. Kan, P. F. & Windsor, J. (2010). Word learning in children with primary language impairment: A meta-analysis. *Journal of Speech, Language & Hearing Sciences*, 53, 739-756
2. Dollaghan, C., & Campbell, T. F. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research*, 41, 1136-1146
3. Abel, A. D., Sharp, B. J., & Konja, C. (2020). Investigating implicit and explicit word learning in school-age children using a combined behavioral-event related potential (ERP) approach. *Developmental Neuropsychology*, 45(1), 27-38.

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