Word Learning From Context in School-Aged Children with SLI: An EEG Study

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INTRODUCTION

- Word learning from context
  - Using surrounding linguistic information to infer a word's meaning[1]
  - Primary means by which school-age children acquire vocabulary[2]
  - Existing research uses behavioral measures, which assess the final stage of learning but not the *process* of word learning process[3,4]
- Event Related Potentials (ERPs)
  - Offer way to index incremental changes in processing without overt behavioral responses
  - N400 - index of lexical processing; has been shown to be sensitive to word learning in children and adults[5,6]

PURPOSE

Combine behavioral and ERP measures to examine the processes underlying word learning from context in school-aged children with SLI

METHODS

PARTICIPANTS

- 14 children average age= 9;4
  - 7 children with SLI
  - 7 typical language (TL) age-equivalent peers
- Inclusion criteria: Right-handed, monolingual English, no significant neurological issues, normal nonverbal cognition

PROTOCOL

- Behavioral assessment battery
  - Wechsler Intelligence Scale for Children-5th edition (WISC)[7]
  - Clinical Evaluation of Language Fundamentals-4th edition (CELF)[8]
  - Peabody Picture Vocabulary Test-4th edition (PPVT)[9]
  - Expressive Vocabulary Test-2nd edition (EVT)[10]
  - Nonword repetition Task (NRT)[11]
- Word learning from context task

Table 1. Behavioral assessment battery; Mean (SD)

	WISC	CELF*	PPVT**	EVT**	NRT*
SLI	98.0 (8.5)	75.0 (11.9)	91.14 (5.24)	98.0 (7.9)	81.88% (10.4)
TL	101.57 (6.6)	111.43 (10.9)	107.57 (6.1)	107.14 (9.4)	94.71% (1.6)

*p<0.01, ** p<0.001

WHAT IS SPECIFIC LANGUAGE IMPAIRMENT (SLI)?

- The most prevalent neurodevelopmental language disorder in children, affecting 7% of children[12]
- Characterized by language deficits without other concomitant diagnoses
- Affects ability to comprehend and produce language, including vocabulary and word learning

WORD LEARNING TASK STIMULI AND PROCEDURE

- Sentences 6-9 words in length organized into sets of triplets
- Target novel word sentence-final
- Test question (after each triplet): Is there a meaning for the novel word? If so, what is it?
- Auditory presentation of stimuli

Table 2. Word learning task example stimuli

Conditions (50 Triplets Each)	Sentence #	Example triplet (novel word in italics)
Meaning	1	The two boys fought over the *shap*.
Sentence triplet supports the novel word's	2	They played catch with the *shap*.
meaning	3	In gym class, I like to throw the *shap*.
No Meaning	1	He was cold because he forgot his *gime*.
Sentence triplet does not provide support	2	My cat is afraid of my *gime*.
for learning the novel word's meaning	3	She took a nap on the *gime*.

RESULTS

Table 3. Accuracy on word learning task, M (SD)

	Meaning *	No Meaning n.s.
SLI	49.7 (19.9)	62.9 (30.5)
TL	73.4 (4.5)	78 (12.9)

* p<0.01

Table 4. Individual differences in word learning

Outcome	Predictors
Behavioral word learning	EVT R^2=0.56, p<0.05
	CELF R^2=0.48, p<0.05
EEG learning effect	PPVT R^2=0.34, p<0.05
	EVT R^2=0.24, p=0.07

Figure 1. ERP voltage maps showing differences between sentences 300-600ms post-novel word onset, Meaning condition

TL   SLI

Sentence 1 to Sentence 2

Sentence 2 to Sentence 3
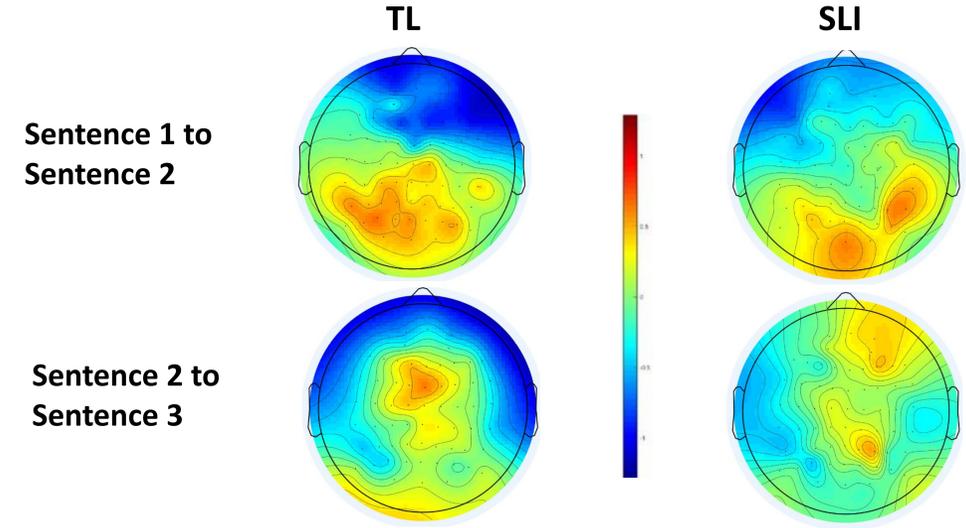
FINDINGS

GROUP FINDINGS
- Behavioral word learning:
  - Children with SLI learned fewer words compared to TL controls
- EEG learning effects:
  - N400 amplitude increase across sentences with contextual support for word learning
  - Learning effect for both groups in centro-parietal sites
  - Less learning effect from sentence 2 to sentence 3 for children with SLI
    - Suggests decreased semantic processing during word learning in children with SLI compared to TL peers

INDIVIDUAL DIFFERENCES
- Expressive vocabulary and overall language ability predictors of behavioral word learning accuracy
- Receptive and expressive vocabulary predictors of EEG learning effect

DISCUSSION

- Children with SLI show deficits in word learning from context
- Decreased semantic processing during word learning in the SLI group compared to the TL group.
- Vocabulary knowledge best predicts the engagement of semantic processing during word learning
- Lower vocabulary abilities and atypical engagement of semantic processing in SLI negatively affects word learning ability
- Clinicians should allow for more exposures to a new vocabulary word or concept for children with SLI before expecting the word changing from known to unknown.

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