Implicit and explicit access to partial word knowledge in school-aged children

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INTRODUCTION

Word learning
- Children learn most of their vocabulary incidentally[1]
- Word forms learned with meaning retained better than words learned without meaning in school-aged children[2]
- Explicit learning measures tend to only tap into the final stage of learning
- EEG offers a way to access implicit learning
  - ERP N400 component

N400
- Indexes lexico-semantic processing[3]
- Sensitive to:
  - Semantic learning in school-aged children[4]
  - Meaning attached to nonsense words in the absence of measures of explicit learning[5,6]

PURPOSE

To examine explicit and implicit knowledge of words learned via an incidental word learning task in 8-11 year old children

METHODS

Participants
- 29 typically developing children (M_{AGE}=9;9)
  - 11 male 18 female
- Typically-developing, right-handed, monolingual English speakers with no significant neurological issues and no history of learning or reading difficulties
- Scored within or above normal limits on standardized measures of cognition and language

Standardized Assessment Battery
- Omnibus language- CELF-5
- Receptive vocabulary- PPVT-4
- Expressive vocabulary- EVT-2
- Nonverbal cognition- WISC-5

EEG
- NeuroScan 64-electrodecap EEG System
- EEG data segmented into epochs 500 msec before to 1000 msec after the nonsense word
- Data averaged across trials to create ERP
- N400 time window: 375-475 msec post-nonsense word onset

STIMULI AND PROCEDURE

Semantic Learning Task
- Sets of three sentences, 6-9 words in length
- Nonsense word in sentence-final position
- Auditory presentation of stimuli
- **Meaning**: contextual support for the nonsense word
- **No meaning**: no contextual support for the nonsense word
- Asked to identify the meaning of the nonsense word, if possible

Word Recognition Task
- 200 nonsense words
  - 100 previously heard in Semantic Learning Task
    - 50 from **Meaning** and 50 from **No meaning**
  - 100 **New** words
- Auditory presentation of nonsense words
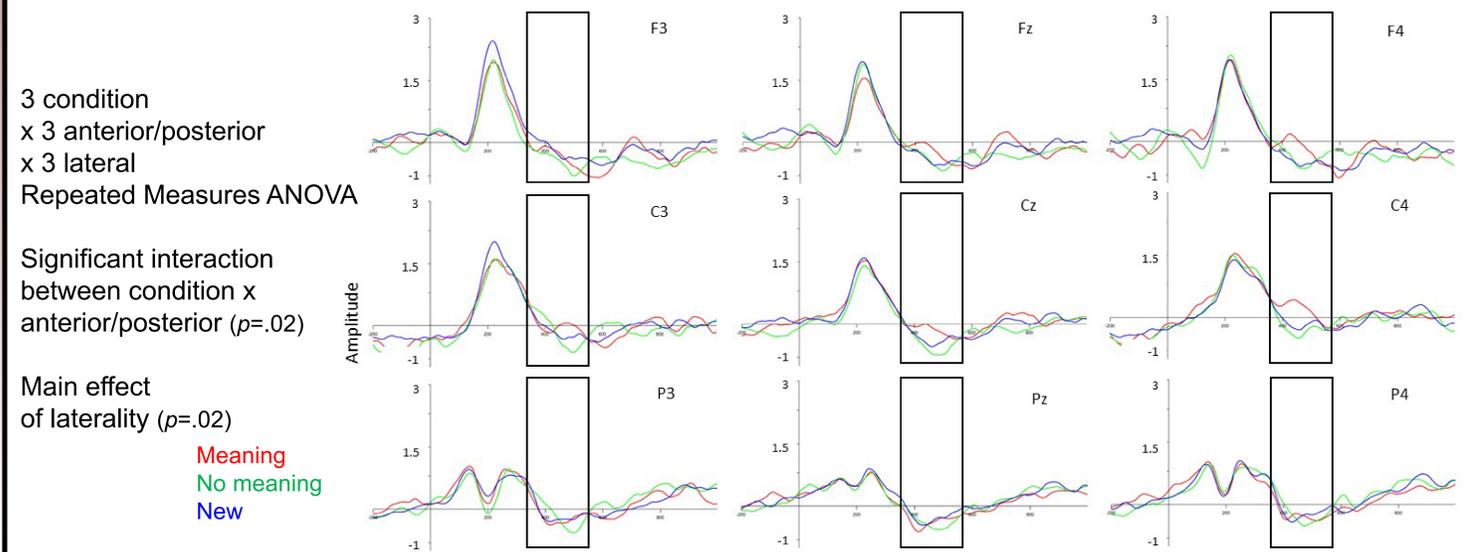- Indicate via button push if they had heard word in previous task

BEHAVIORAL RESULTS

Semantic Learning Task Accuracy*
- **Meaning**: *M*=74.9%, *SD*=8.7%
- **No meaning**: *M*=82.8%, *SD*=11.1%

Word Recognition Task Accuracy**
- **Meaning**: *M*=47.5%, *SD*=13.3%
- **No meaning**: *M*=47.2%, *SD*=12.8%
- **New**: *M*=58.9%, *SD*=16.9%

Pearson's Correlation

	PPVT-4	EVT-2	WISC-5	SL task Meaning	SL task No meaning	WR task Meaning	WR task No meaning	WR task New
CELF-5	0.68**	0.77**	0.71**	0.42*	0.45*	-0.19	-.09	0.05
PPVT-4		0.81**	0.69**	0.48**	0.31	-0.20	-0.24	0.26
EVT-2			0.75**	0.61**	0.21	-0.26	-0.22	0.25
WISC-5				0.43*	0.36	-0.27	-0.20	0.33
SL task Meaning					0.13	-0.44*	-0.37*	0.31
SL task No meaning						-0.01	0.12	-0.01
WR task Meaning							0.76**	-0.71**
WR task No meaning								-0.77**

* p<.05 **p<.01

ERP RESULTS: WORD RECOGNITION TASK

3 condition
x 3 anterior/posterior
x 3 lateral
Repeated Measures ANOVA

Significant interaction between condition x anterior/posterior (*p*=.02)

Main effect of laterality (*p*=.02)

Meaning
No meaning
New

FINDINGS

- Behavioral:
  - Participants were below chance at recognition of all nonsense word forms
  - Moderate-strong *positive* correlations between accuracy on Semantic Learning task and performance on standardized assessments
  - Moderate *negative* correlation between Semantic Learning and Word Recognition performance
- ERP findings:
  - N400 amplitude for Meaning greater than No Meaning, which did not differ from New

DISCUSSION

- Task requirements may influence the acquisition of a new word
  - Introducing a nonsense word with semantic meaning results in poorer explicit word recognition but improved implicit access to semantic meaning
- Implicit and explicit access to word form and semantic meaning knowledge comes online at different times
  - N400 can access implicit semantic knowledge of newly-learned words that is not yet available explicitly
- It is important to examine all aspects of the lexical entry during the study of word learning
  - Successful word form learning does not guarantee meaning acquisition and vice versa

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