Neural Oscillations Related to Word Learning from Auditory Context

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INTRODUCTION

Adults learn much of their vocabulary by using the surrounding linguistic context to identify a new word's meaning, or *word learning from context*[1-4]. Word learning from context is essential to vocabulary growth beginning in grade school; however, we know little about the process in general. Additionally, while previous word learning from context research has primarily focused on written text, explicit vocabulary teaching studies show word learning differences between written and auditory modalities[5,6].

PURPOSE

Examine the neural processes underlying learning from auditory context, when visual cues from the written word are not present to help ground meaning representation.

METHODS

PARTICIPANTS

- Right-handed, monolingual English speakers
- 12 adults, ages 19-23 years

EEG EQUIPMENT

- Neuroscan EEG System, 62 electrode cap

EEG ANALYSIS

- Data epoched -500 msec before to 1000 msec after the target word, Fourier transformed, magnitude squared, and normalized
- Power spectrum data averaged across trials and subjects and computed using the log power values minus the baseline
- Mean baseline power at each electrode and frequency subtracted[7]
- Statistical significance (p<0.05) determined using random permutation statistical analysis
- Only statistically significant clusters of 3 or more electrodes were considered in interpretations
- Study design:
  - 2 Condition (Meaning, No meaning) x
    - 3 Sentence (1,2,3) ANOVA

STIMULI AND PROCEDURE

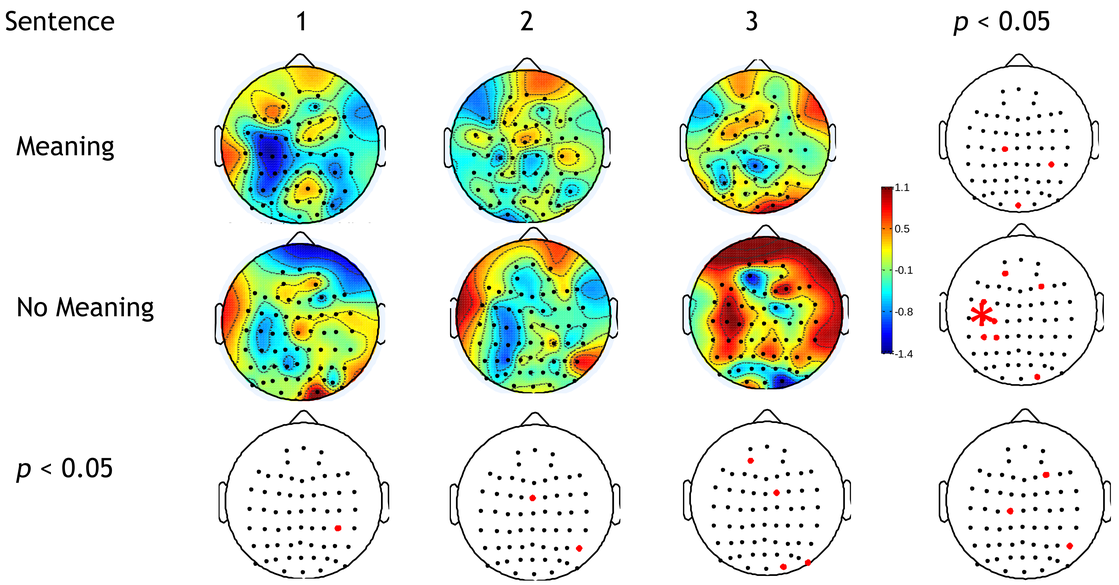
Auditory word learning from context task[4]:
Sentence triplets
Target word in sentence-final position
Participant asked to identify the target word's meaning after each triplet

Conditions (50 triplets each)	Sent #	Example triplet (target in italics)
Meaning sentence triplet supports the target word's meaning	1	Her parents bought her a *chut*.
	2	The sick child spent the day in his *chut*.
	3	Mom piled the pillows on the *chut*.
No Meaning sentence triplet does not provide support for learning the target word's meaning	1	His favorite toy of all time is the *vik*.
	2	He had a lot of food on his *vik*.
	3	Before bed, I have to take a *vik*.

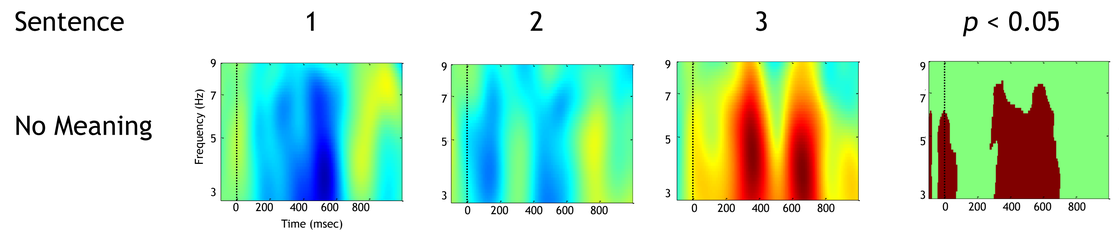
BEHAVIORAL FINDINGS

Meaning: 85.2% (*SD*=6.7%); No Meaning: 89% (*SD*=5.9%)

THETA (4-8 Hz)



Main effect: Sentence (p<0.05) for No Meaning condition; C5, 350-450 msec



FINDINGS

BEHAVIORAL

Lower than expected accuracy in identifying the target word's meaning

- Difficulty identifying target words' meanings even when the context supported learning

EEG

Theta increase over left central sites

- Meaning condition: Not significant
- No Meaning condition: Significant electrode cluster
  Driven by changes in the 3rd sentence
- Suggests increased working memory efforts when accessing the previous sentences to determine whether the target word has a meaning

CONCLUSIONS

Despite the fact that adults learn most of their new vocabulary via word learning from context, this appears to be a challenging task. Adults appear to engage more working memory when attempting to find a meaning for a target word with no contextual support present. Conversely, when the target's meaning is clear, working memory is not engaged as much.

Importantly, it seems that examining neural changes at the level of the target word, as is common in EEG/ERP studies of word learning, may not uncover linguistic processes involved during word learning. Future work will explore neural activity associated with other aspects of the word learning process.

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