

INTRODUCTION

Naturally-spoken English flies by at 6.19 syllables per second, yet an English speaker can process the phonology, semantics, and syntax of auditory signals with ease. How is this possible? The current study addresses this question in relation to the development of verbal working memory in children.

BACKGROUND

Many theories point to a reliance on verbal working memory for the ability to process sentences(1-4). Supporting this idea, Bastiaansen et al. (2002) reported a theta power increase with each word during word-by-word visual presentation of a sentence. They interpreted these theta changes as increasing engagement of working memory related to language comprehension.

Generally, working memory improves rapidly between ages 4 to 8 and continues to gradually improve until age 12 when it begins to resemble adult working memory processes (6). This study seeks to better understand the development of working memory related to sentence processing during this time of gradual improvement between ages 8 to 12.

METHOD

Participants.

- Right-handed, monolingual English speakers
 - Children: $N = 13$, age range 8-12, 7 males
 - Mean Age= 10.3 years, Standard Dev.=1.11 years

EEG Equipment.

- Neuroscan EEG System, 62 electrode cap

Methods.

- Performed grammaticality judgments for 160 sentences: 80 incorrect & 80 correct. (Only data from correct sentences are included in the analysis).
- The data were epoched (0-3500 msec) and averaged based on condition and task.
- For each epoch a time frequency analysis was performed to identify the underlying oscillatory activity.

STIMULI

Singular Grammatical (SG):

“Before the game begins, **she picks** people to be on her team”

Singular Ungrammatical (SU):

“Before the game begins, **she pick** people to be on her team”

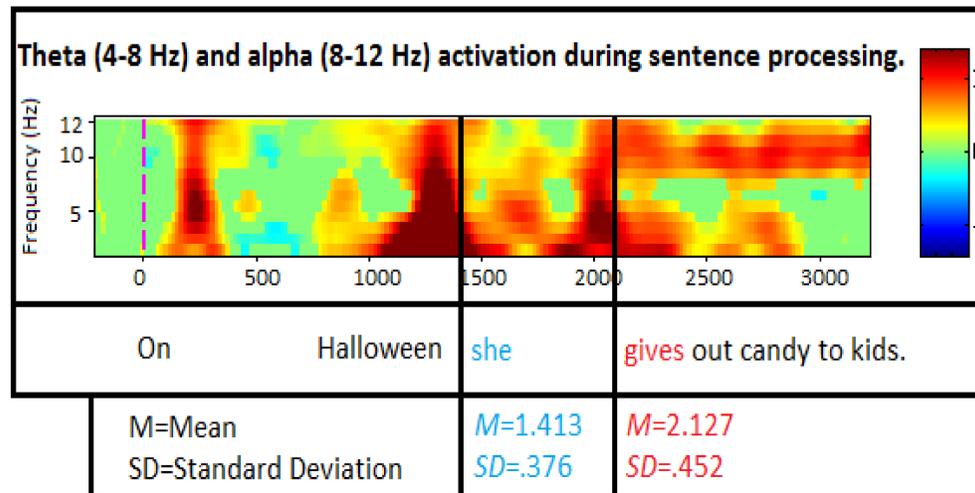
Plural Grammatical (PG):

“Before the game begins, **we pick** people to be on our team”

Plural Ungrammatical (PU):

“Before the game begins, **we picks** people to be on our team”

TIME FREQUENCY RESULTS



SUMMARY OF FINDINGS

- **Theta** increases progressively through the sentence
- The largest increase in **theta** surrounds the agent (1.41 sec) and the main verb (2.13 sec) of the sentence
- Following the verb there is a significant increase in **alpha** power

DISCUSSION

These are the first data to investigate processing of real-time auditory sentences in children.

- The gradual increase in **theta** is similar to results by Bastiaansen et al. (2002,2010) which highlighted the importance of working memory in sentence comprehension during a reading task .

There are two possible interpretations related to alpha:

- **Alpha** is related to inhibition and neural idling, suggesting that once participants noted the verb was grammatically correct, they disengage from processing (8-9).
- **Alpha** measures verbal working memory (10-12). This theory would suggest participants continue to engage working memory processes throughout the entirety of the sentence.

FUTURE DIRECTIONS

We hope to expand on the previous findings in two ways:

1. Determine whether alpha represents neural idling or working memory
2. Use as a baseline for studying children with language delays and disorders

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