

Individual Variation in the Time Course of Statistical Word Segmentation: An ERP Investigation

Nicolette B. Noonan¹, Lisa M. D. Archibald^{1,2}, & Marc F. Joanisse¹

1. The Brain and Mind Institute, Department of Psychology, The University of Western Ontario

2. Communication Sciences and Disorders, The University of Western Ontario

nnoonan3@uwo.ca



Introduction

- Statistical learning occurs implicitly
- However, conventional forced-choice explicit tests may not accurately reflect learning (e.g., Romberg & Saffran, 2013).
- Although viewed as a key mechanism for language acquisition, statistical language learning abilities vary even in typical adult populations.
- Examining neural indices of word identification may give us a better understanding of sensitivity to newly-segmented words, and help quantify individual variation.
- The present study measured neural event-related potentials (ERPs) in response to newly learned versus unlearned “words”. We examined the relation between ERP and behavioural responses to newly segmented words following exposure to a novel language

Method

Participants

17 young adult
English monolingual; normal hearing/vision

Stimuli

Artificial language

6 tri-syllabic “words”, structured unsegmented stream

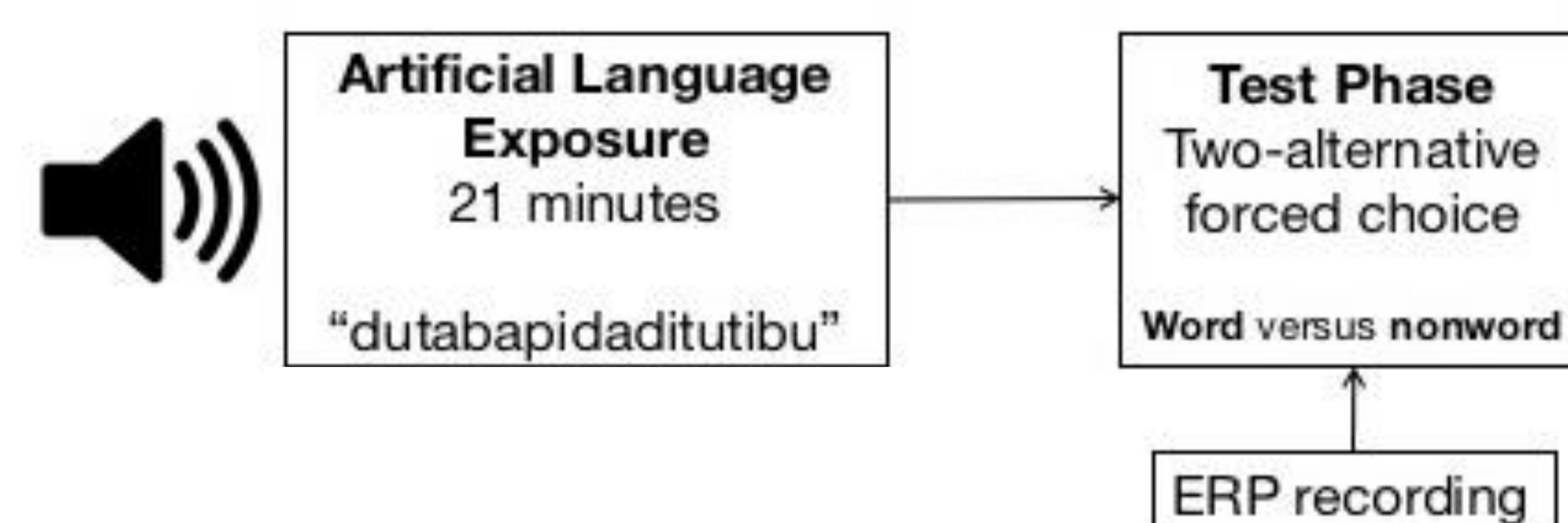
→ W/in word transitional probability = 0.3-1.0 (e.g.: Saffran et al., 1997)

Test phase

“Word” from artificial language + Non-word foil

→ W/in word transitional probability of non-word = 0.0

Procedure

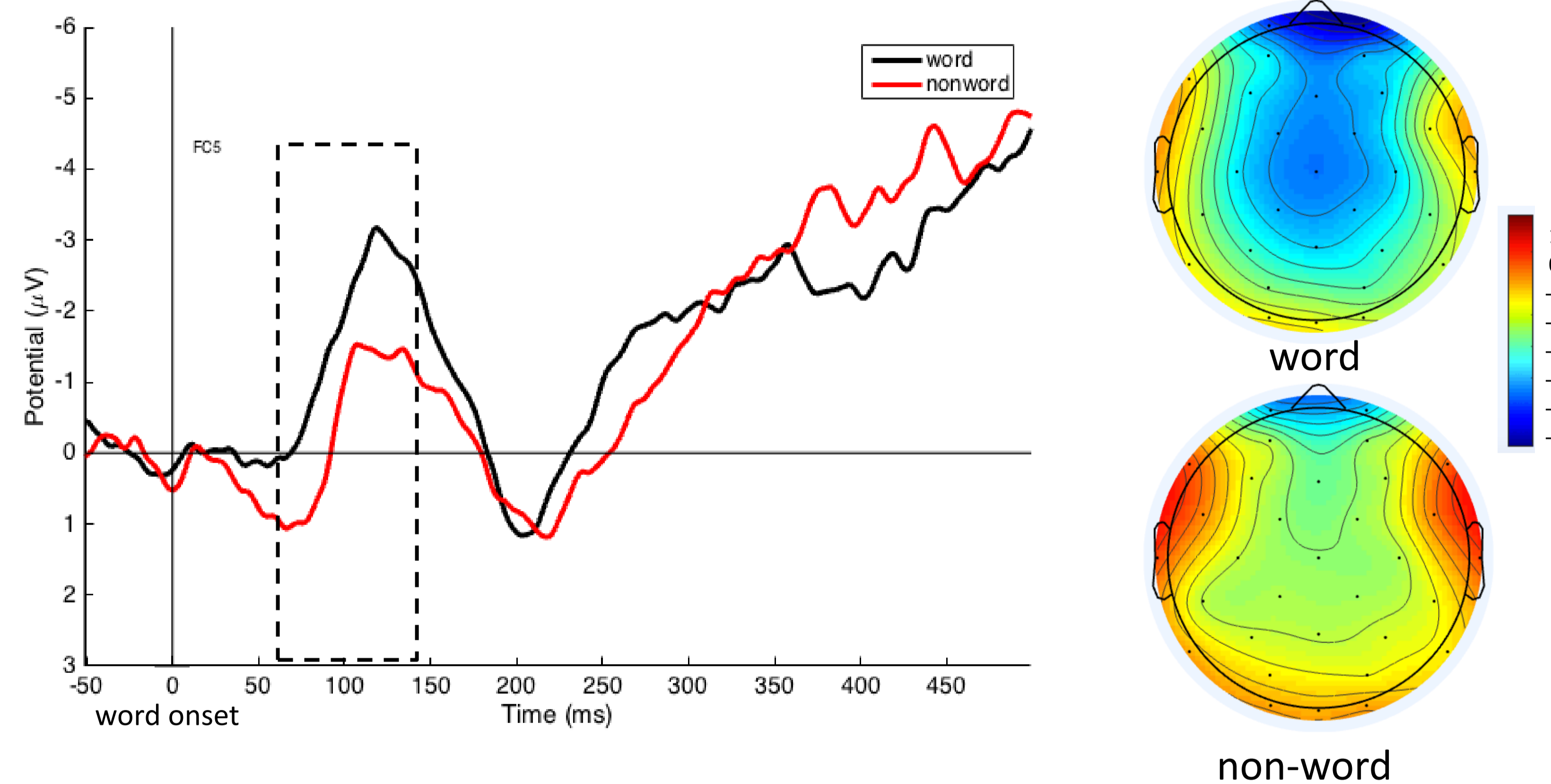


- Test phase: 36 auditorily presented word versus non-word pairs
→ Two-alternative forced-choice (2AFC)
- Measured participants’ behavioural responses
- Measured ERP response to words versus non-words, time-locked to stimulus onset

Results

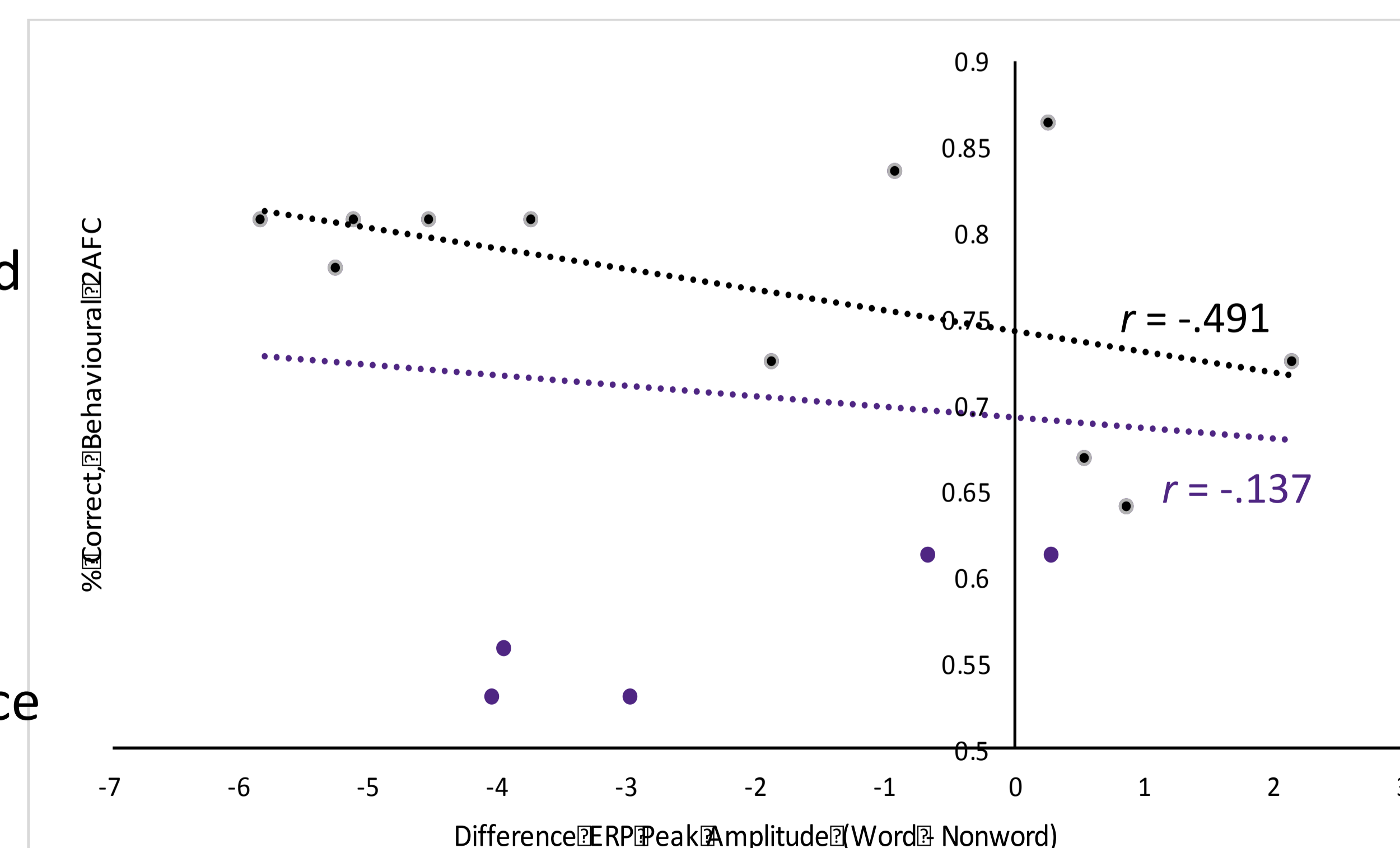
75-150ms after word onset

Higher peak amplitude for word versus non-word at test over middle frontal and central midline electrode sites (F3, FC5, C3, CP1, Pz, FC2, and F4; marginally different over FC6 and Cz)



Correlation of behavioural and ERP responses

2AFC scores correlated with difference in peak amplitude for word minus non-word evoked responses only for above-chance learners (black), but not when below-chance learners (purple) are included



Conclusions

- ERPs differentiated newly-segmented words from non-words
 - Enhanced N100 in response to “word” onset (Sanders et al., 2003)
 - May index of word segmentation (Sanders et al., 2002)
- Significant correlation between magnitude of the ERP effect and behavioural outcome measure
 - Demonstrates a relationship between implicit and explicit measures of statistical word segmentation
 - Effect was not present when below-chance performers were included
 - May reflect inaccurate segmentation strategies adopted by below-chance performers
- Successful word segmentation was reflected by both an explicit behavioural test and implicit measures of neural responding

References

Romberg, A. R., & Saffran, J. R. (2013). All together now: Concurrent learning of multiple structures in an artificial language. *Cognitive science*, 37(7), 1290-1320

Sanders, L. D., & Neville, H. J. (2003). An ERP study of continuous speech processing: I. Segmentation, semantics, and syntax in native speakers. *Cognitive Brain Research*, 15(3), 228-240.

Sanders, L. D., Newport, E. L., & Neville, H. J. (2002). Segmenting nonsense: an event-related potential index of perceived onsets in continuous speech. *Nature neuroscience*, 5(7), 700-703.

The authors have no financial or non-financial relationships relative to the content of this poster that compromise or have the potential to compromise professional judgment.

Presented at: SRCLD; June, 2016