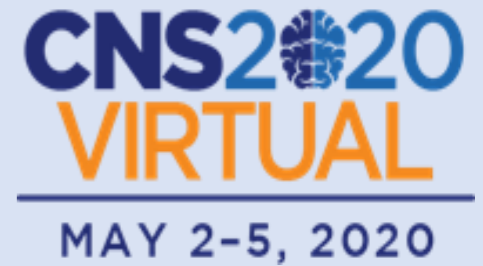




Neurophysiological evidence for sensitivity to English semantic but not syntactic anomalies in native Chinese speakers

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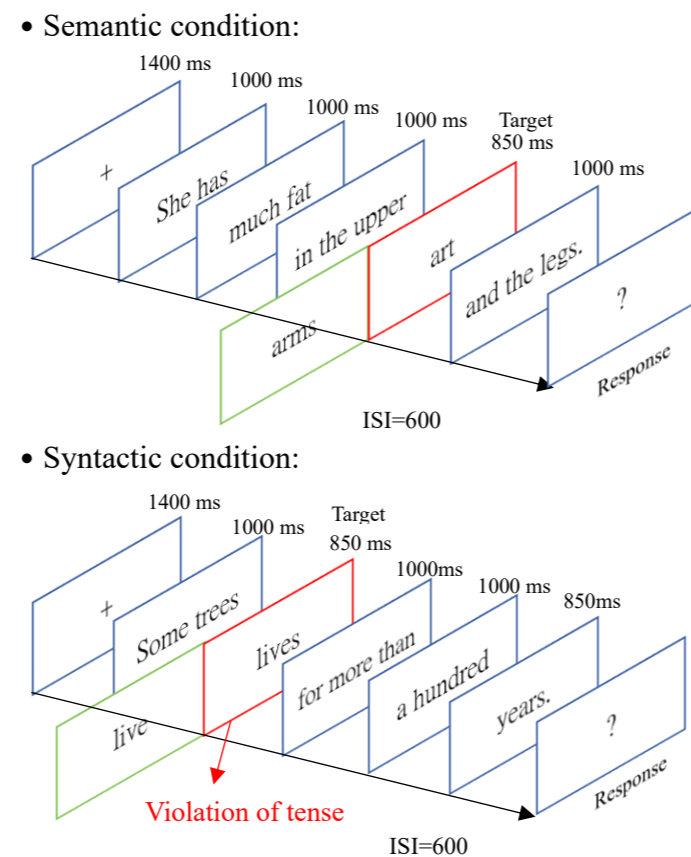
Introduction

- Previous research has demonstrated that semantic and syntactic anomalies in sentences elicit specific neurophysiological components in native speakers across different languages (Ojima et al., 2005).
- Whether similar neural correlates of semantic and syntactic processing would be identified in learners of a foreign language and whether the sensitivity underlying such correlates is associated with other cognitive abilities are still open questions.
- Among other cognitive abilities, we especially pay attention to statistical learning, including visual and auditory modalities.
- In the present study, college students who are native speakers of Mandarin read English sentences, half of which were with semantic or syntactic anomalies, while their brain activities were simultaneously recorded by electroencephalography (EEG).

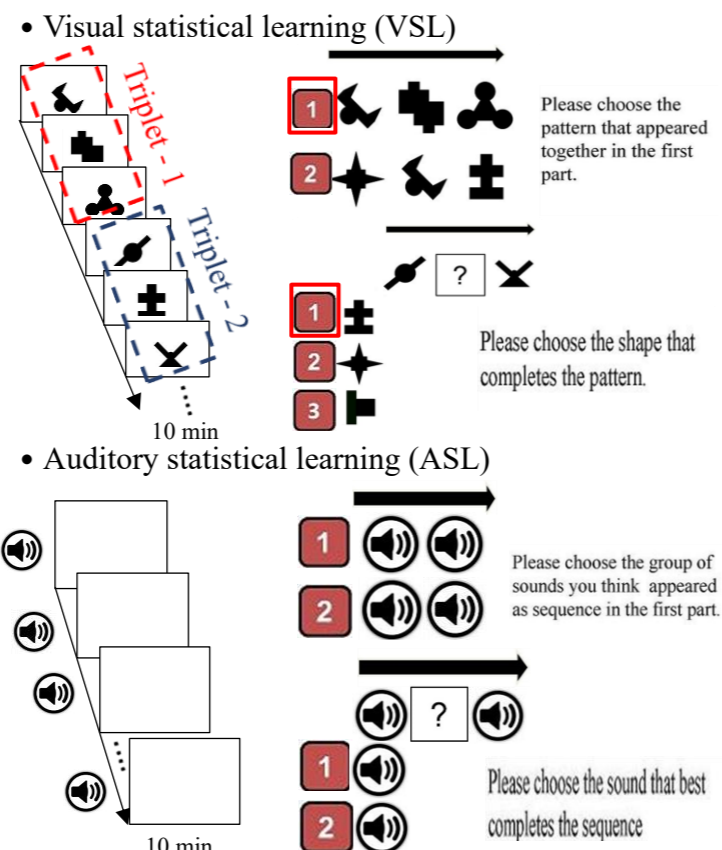
Method

- Participants: N = 14, 6 male; M_{age} = 21.4 (13 with behavior data; 6 with scores of statistical learning, IQ tests and working memory tests)
- All participants started to acquire English from 4 to 9 years old in school. For 12 participants whose English proficiency in standardized tests was obtained, all of them achieved the top level in the general scholastic ability test (GSAT) in Taiwan. M_{TOEIC} = 793.75 (range = 760±180)
M_{daily usage of English} = 4.3 hr (range = 6.75±5.75)
- EEG recording: 64 channels; sampling rate = 1000 Hz
- Task = Acceptability judgment on each English sentence

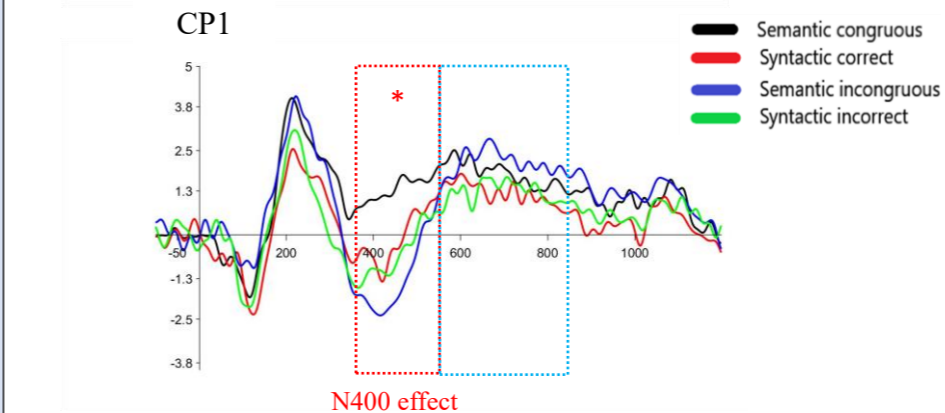
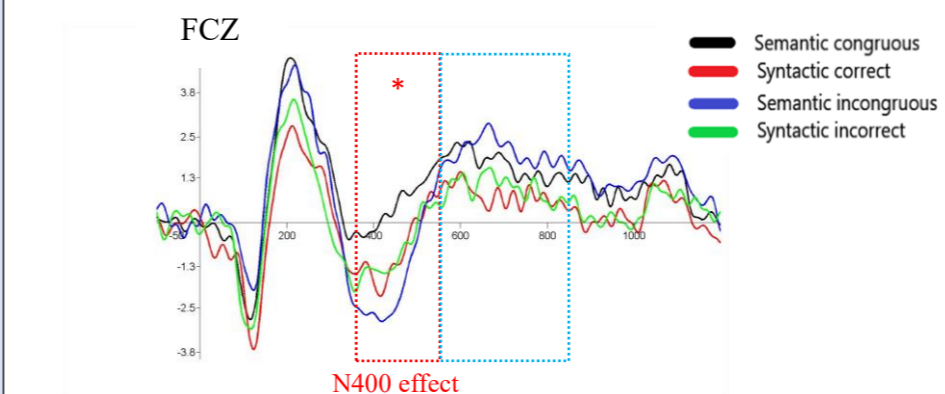
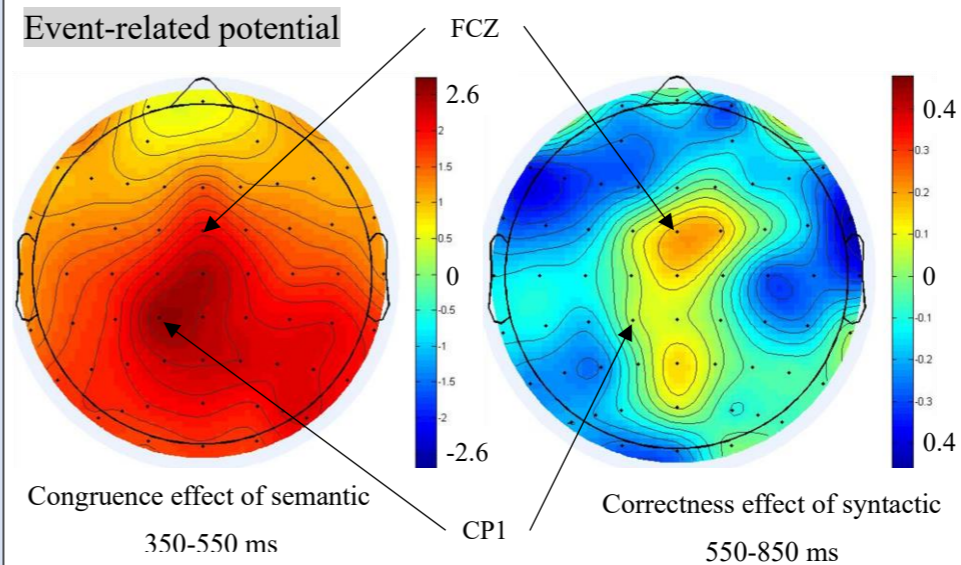
Acceptability judgment on each English sentence



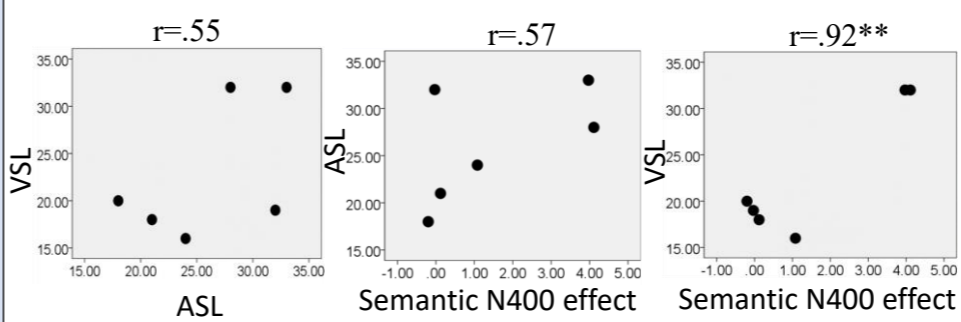
Statistical learning (N = 6)



Results



Correlation with statistical learning (N = 6)



Conclusions & Discussion

- The neurophysiological responses were consistent with participants' behavioral accuracy, which showed better (though not significantly) performance in the semantic than the syntactic condition.
- The ERP results revealed that semantic anomalies evoked a stronger N400 component than the same word in a normal sentence context.
- In participants whose abilities of statistical learning (SL), IQ and working memory were measured, the magnitude of the N400 effect tended to correlate with SL in both the auditory and visual modalities, but it seems not to correlate with IQ ($r_{Block\ Design} = -.64$; $r_{CFT} = -.17$) or working memory ($r_{Corsi} = -.06$; $r_{LetNum} = .35$).
- These results indicated that learners of a foreign language with sub-optimal proficiency are sensitive to the regularity in semantics in a way similar to native speakers. In contrast, the sensitivity to the regularity in syntax might be weak or non-existent at this stage, and requires further learning/experience to develop.

References

Shiro Ojima, Hiroki Nakata1, Ryusuke Kakigi1. An ERP Study of Second Language Learning after Childhood: Effects of Proficiency. Journal of Cognitive Neuroscience. 2005;17:1212-1218

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