Examining sensitivity to binding constraints by Chinese learners of English: An Event-Related Potential (ERP) study

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This study investigates Chinese-speaking learners of English's sensitivity to binding constraints [1], using electrophysiology (EEG). We compared the processing of reflexives (1a/b) with the processing of pronouns (1c/d) in order to see if L2 learners adhere to grammatical constraints on binding online, similar to native speakers (e.g., [2]). In (1a/b), following Binding Principle A (i.e., an anaphor must be bound within the local binding domain), '*himself*' must co-refer with the local antecedent '*Adam*'. In contrast, in (1c/d), following Binding Principle B, the pronoun '*him*' must be free within the binding domain, thus the pronoun in (1d) can co-refer with the long-distance antecedent '*Adam*' or can potentially co-refer with a novel antecedent not mentioned in the sentence (e.g., [3]). Sentences with binding Principle A violations such as (1b) have been shown to yield a significant P600 for native speakers (e.g., [2]). However, for sentences containing a gender mismatching pronoun such as in 1d), studies have observed a P600 or an Nref, reflecting referential difficulty or the attempt to posit an unmentioned extrasentential referent (e.g., [3]).

Mandarin Chinese is a long-distance binding language such that in (2a), *ziji* 'self' can refer to either a local '*Lisi*' or a long-distant antecedent '*Zhangsan*'. Similar to English, the coreference of Chinese pronoun *ta* 'him/her' and its corresponding antecedent is constrained by Principle B, as in (2b), and can potentially refer to an unmentioned novel antecedent. Thus, if there are transfer effects, Chinese learners may show a lack of sensitivity in the reflexive conditions (1a/b), where they may allow a long-distance antecedent, but show native-like processing (P600 or Nref) for pronouns (1c/d).

Previous L2 studies using offline measures have shown that acquisition of binding constraints in the L2 is possible for some learners despite L1/L2 differences (e.g., [4, 5]) while some studies using eye-tracking found that, L2 learners may be more likely to consider an antecedent not allowed by binding constraints when the antecedent is in a discourse-prominent position, such as the subject position (e.g., *Wendy* in 1a) (e.g., [6]). The Shallow Structure Hypothesis (SSH) argues that L2 learners rely more on discourse prominence than syntactic constraints during processing (e.g., [7]). If this proposal is on the right track, L2 learners may prefer subject antecedents for *both* pronouns and reflexives, thus showing a P600 for pronouns, but a reverse effect for reflexives in which the response to (1a) (*Wendy/himself*) would show a P600 in comparison to (1b) (*Adam/himself*).

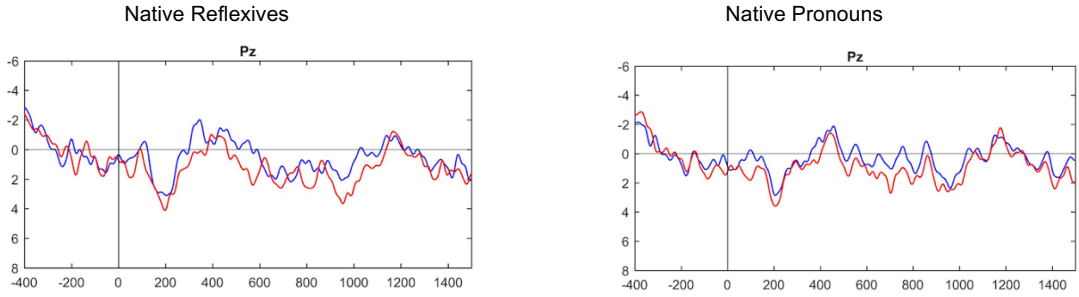
Fifteen intermediate-to-high proficiency Chinese-speaking learners and sixteen English L1 speakers were asked to read 160 English sentences in four conditions (Table 1) word by word, followed by comprehension questions. They also completed two offline tasks examining sensitivity to binding and gender; both tasks showed target-like performance. ERPs time-locked to the onset of the reflexive/pronoun region were analyzed in 500-900ms (P600) and 500-1400ms (Nref) time windows. Our preliminary results showed that, for native speakers, the two violation conditions yielded a significant P600 as compared to their respective grammatical conditions (Fig. 1), suggesting sensitivity to the binding constraints. The native results for pronouns provide new evidence suggesting P600 may emerge for sentences without a binding-theory compatible referent within the sentence, even when the task does not require participants to evaluate the match/mismatch between the pronoun and potential referents within the sentence (see [3]). Results for the L2 learners did not show P600s (Fig. 2). Instead, the L2 learners showed a sustained negativity for both reflexives and pronouns (significant in anterior regions in the 500-1400ms window), which resembles an Nref (e.g., [8], [9]). Thus, despite offline sensitivity to binding constraints, the ERP results suggest referential difficulty for the L2 learners for both pronouns and reflexives, different from native speakers. These preliminary results do not currently support either L1 transfer, which would predict a lack of sensitivity for reflexives (1a≈1b), or SSH, which would predict a P600 for pronouns and a reverse effect for reflexives (1a more positive than 1b) but we will continue to evaluate these hypotheses as data collection continues.

Table 1: Examples of the target conditions

Reflexives	
1a. Grammatical reflexive	Wendy$_j$ thought that Adam$_i$ trusted himself$_{i/*j}$ before the mistake.
1b. Principle A-violation	*Adam$_i$ thought that Wendy$_j$ trusted himself$_{*i/*j}$ before the mistake.
Pronouns	
1c. Grammatical pronoun	Adam$_i$ thought that Wendy trusted him$_{i/k}$ before the mistake.
1d. Principle B-violation	#Wendy$_j$ thought that Adam$_i$ trusted him$_{*i/*j/k}$ before the mistake.

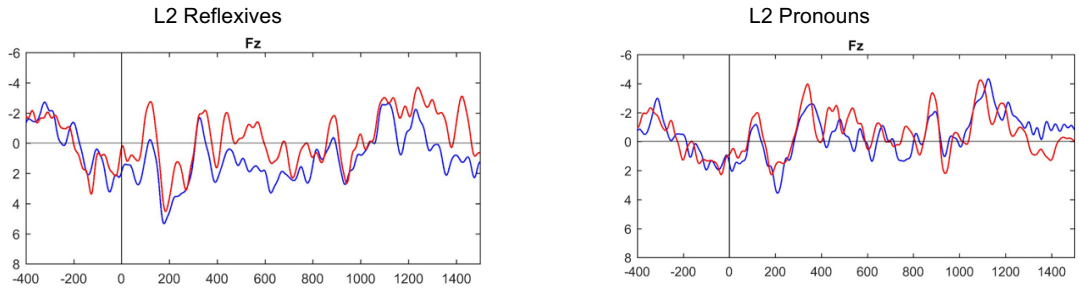
2a. 张三 说 李四 相信 自己。
Zhangsan shuo Lisi xiangxin *ziji*.
Zhangsan say Lisi trust self
'Zhangsan$_i$ said Lisi$_j$ trusted himself$_{i/j}$.'

2b. 张三 说 李四 相信 他。
Zhangsan shuo Lisi xiangxin *ta*.
Zhangsan say Lisi trust 3SIG
'Zhangsan$_i$ said Lisi$_j$ trusted him$_{*i/j/k}$.'



----Grammatical conditions ----Binding violation conditions

Fig 1. Native ERPs in reflexive conditions (left) and non-reflexive conditions (right) at electrode Pz.



----Grammatical conditions ----Binding violation conditions

Fig 2. L2 ERPs in reflexive conditions (left) and non-reflexive conditions (right) at electrode Fz.

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