ERPs reveal that quantification matters for both L1 and L2 processing of subject-verb agreement: English natives and Chinese L2ers compared

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In research on L1 and L2 comprehension, some have claimed that L2ers cannot acquire morphological features absent in the L1 in a nativelike way [4], while others argue that L2ers have difficulty computing non-local dependencies [3]. To examine these issues, we present data from an ERP study investigating the processing of non-local agreement violations, focusing on how this process interacts with quantification in English natives and Chinese L2 English speakers, whose L1 lacks number agreement. [1] offered ERP evidence suggesting that Chinese L2ers process local agreement errors like (1) in a native-like way. However, some previous ERP work [2] found that Chinese L2ers in a non-immersion setting process agreement violations in a qualitatively different way when an intervening NP is embedded between the subject and the verb as in (2). This process has been shown to be modulated by lexical information in both L1 and L2 processing. [5] showed that quantified subjects facilitate natives' sensitivity to local agreement violations in sentences like (3), whereas [1] found the opposite in Chinese L2ers using the same materials. To extend on these previous studies, we tested the extent to which ERP responses to non-local agreement violations in English natives and Chinese L2ers in an immersion setting are similar, and whether lexical-based cues from quantification regulate this process in both groups.

We tested 32 English natives and 32 Chinese L2ers studying at a university in the UK. They read 160 experimental sentences (plus 160 fillers) in a 2x2 design manipulating quantification and grammaticality as in (4-7). Stimuli were presented in an RSVP format while EEG was being recorded and participants had to make a grammaticality judgment after each sentence. The subject was either singular (4&6) or plural (5&7), and the intervening NP and verb were always singular, meaning half the sentences were grammatical and half ungrammatical. We expected ERPs time-locked to the onset of the critical verb ('is') to elicit a stronger positivity in the P600 time window in ungrammatical than grammatical conditions. Quantification was also manipulated: half of the subjects were unquantified (4-5) and half were quantified (6-7). If quantification facilitates detection of ungrammaticality, the difference in P600 amplitude between grammatical and ungrammatical conditions should be larger with quantified (6-7) than unquantified subjects (4-5).

Results from a midline analysis show a significant grammaticality effect with no group interaction: sentences containing agreement violations elicited a larger positivity with a posterior distribution in the P600 time window for both L1 and L2ers, see Figure 1. Also, we observed a significant grammaticality by quantification interaction: the P600 effect for agreement violations was larger with quantified than unquantified subjects. Again, and unlike in [1], this did not significantly differ between groups.

Our findings suggest that both groups processed non-local agreement violations in a qualitatively similar way, and that the direction of effects related to lexical information from quantification, with larger P600 effects for quantified subjects, was the same in both groups (contra [1,2]). This suggests that Chinese speakers of English, at least in an immersion setting, are able to acquire novel L2 features and employ the same underlying mechanisms as L1ers for both syntactic and lexical processing. Our results in regard to how quantification modulates agreement processing might differ from [1] because the intervening NP provided the L2ers with more time to integrate the information from the quantified subject than in their materials. Although our L2ers were tested in an English immersion setting, they varied in proficiency (mean = 40/60, range 24-54) and length of immersion experience (mean = 17.7 months, range 2 months to 4 years), indicating that acquisition of the relevant features and subsequent processing of them even when syntactic information is required is not as formidable a task as some theories predict.

Examples
(1)   * The cookies tastes the best when dipped in milk.
(2)   * The key to the cabinets are over there.
(3)   * Many cookies tastes the best when dipped in milk.

(4)   The window of the house is really clean.   (Unquantified, Grammatical)
(5)   * The windows of the house is really clean.   (Unquantified, Ungrammatical)
(6)   That window of the house is really clean.   (Quantified, Grammatical)
(7)   * Those windows of the house is really clean.   (Quantified, Ungrammatical)

Figure 1: Grand average waveforms at Pz

Native speakers of English   Chinese speakers of English

—— Unquantified, Grammatical   —— Unquantified, Ungrammatical
—— Quantified, Grammatical   —— Quantified, Ungrammatical

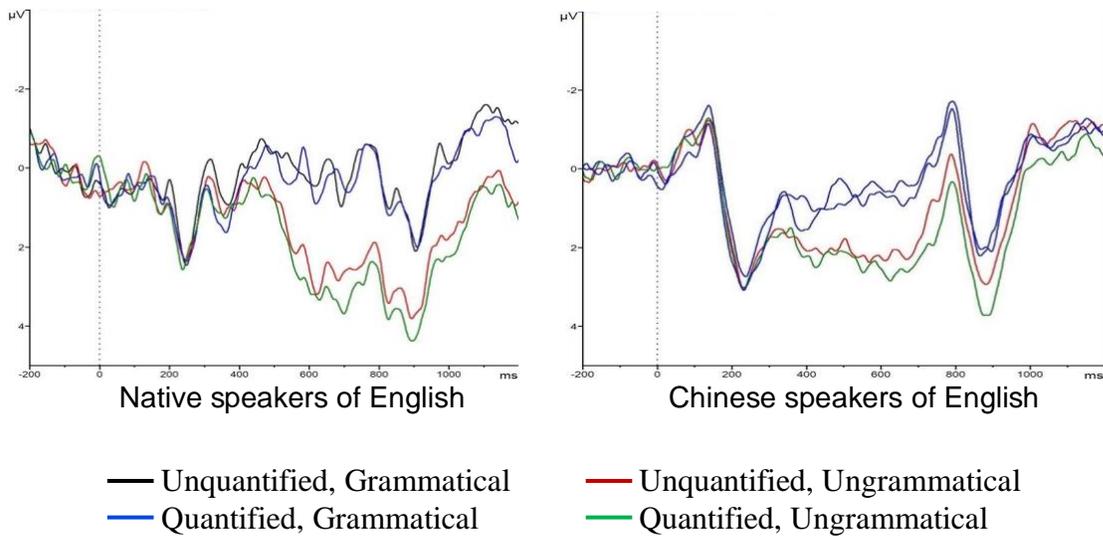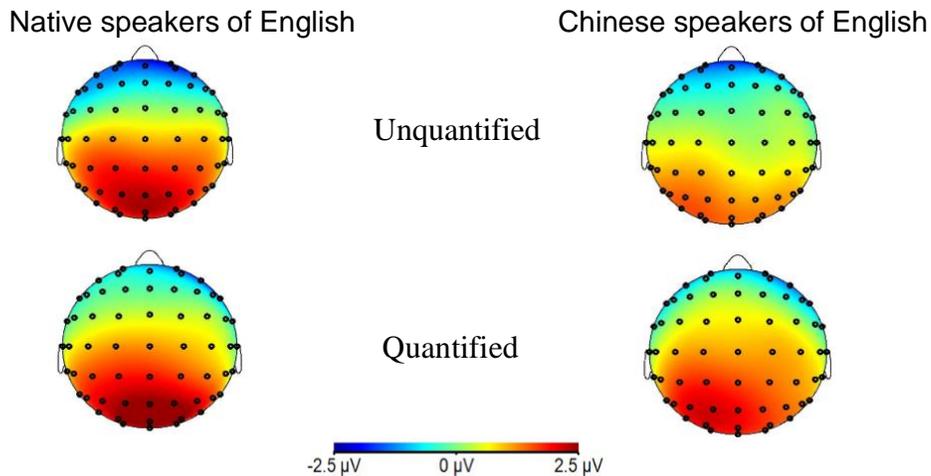Figure 2: Topographic distribution of ERP effects in the 500-850ms interval at the critical verb (grammatical vs. ungrammatical conditions)

Native speakers of English   Chinese speakers of English

Unquantified

Quantified

-2.5 µV   0 µV   2.5 µV

References
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