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# Processing foreign-accented speech in a second language: Evidence from ERPs during sentence comprehension in bilinguals*

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*This study examined electrophysiological correlates of sentence comprehension of native-accented and foreign-accented speech in a second language (L2), for sentences produced in a foreign accent different from that associated with the listeners' L1. Bilingual speaker-listeners process different accents in their L2 conversations, but the effects on real-time L2 sentence comprehension are unknown. Dutch–English bilinguals listened to native American-English accented sentences and foreign (and for them unfamiliarly-accented) Chinese-English accented sentences while EEG was recorded. Behavioral sentence comprehension was highly accurate for both native-accented and foreign-accented sentences. ERPs showed different patterns for L2 grammar and semantic processing of native- and foreign-accented speech. For grammar, only native-accented speech elicited an Nref. For semantics, both native- and foreign-accented speech elicited an N400 effect, but with a delayed onset across both accent conditions. These findings suggest that the way listeners comprehend native- and foreign-accented sentences in their L2 depends on their familiarity with the accent.*

Keywords: foreign accent, sentence comprehension, second language, ERPs, grammar, semantics

## Introduction

Listeners and speakers from different language backgrounds interact frequently, and the growing prevalence of multilingualism (Marian & Shook, 2012) implies that such interactions often involve non-native speakers and listeners. A foreign accent is one of the most salient characteristics of a non-native speaker (Flege, Munro & MacKay, 1995; Gluszek & Dovidio, 2010) and foreign-accented speech constitutes an especially challenging example of variability in the speech signal for listeners (Bent & Holt, 2013; Samuel & Larraza, 2015). In native (L1) listeners, this variability generally causes comprehension difficulties (Cristia, Seidl, Vaughn, Schmale, Bradlow & Floccia, 2012; Munro & Derwing, 1995a, 1995b). The present study investigated the processing of foreign-accented speech in non-native (L2) listeners. Specifically, the study examined processing in bilinguals who listened to sentences in their L2 produced by a native speaker of the target L2 (e.g., native-accented speech) and we compared this with the bilinguals' processing of sentences produced with a foreign accent *different* from their own foreign accent.

Foreign-accented speech is arguably even more difficult for L2 listeners than for L1 listeners because not only is the speech more variable than canonical (native) speech, but also comprehension is happening in the listeners' L2. Research shows that L2 comprehension of native-accented speech is already a challenging task. For example, L2 phoneme perception is persistently inaccurate and tends to be constrained by the listeners' L1 phonemic inventory (Strange, 1995). Also, studies on word recognition have found that L2 listeners are more susceptible to lexical competition effects than L1 listeners (Weber & Cutler, 2004).

The general difficulty of speech comprehension in L2 may be attenuated in listening contexts where L2 listeners are processing foreign-accented speech that is congruent with their language background, e.g.,

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Chinese L1–English L2 listeners processing Chinese-English accented speech, compared to native English accented speech. This attenuation has been termed the INTERLANGUAGE SPEECH INTELLIGIBILITY BENEFIT (e.g., Bent & Bradlow, 2003; Hayes-Harb, Smith, Bent & Bradlow, 2008; Imai, Walley & Flege, 2005).

Such work has mainly focused on L2 listeners who are processing speech in native-accented and L1-congruent foreign-accented conditions. Few studies (e.g., Lev-Ari, Heugten & Peperkamp, 2017; Weber, Di Betta & McQueen, 2014) have explicitly examined how L2 listeners process foreign-accented speech that is different from (incongruent with) their own L1 background, for example, Dutch L1–English L2 listeners processing Chinese-English accented speech. With increasing globalization and international communication many L2 speaker-listeners process a variety of foreign accents in their daily conversations. More research on the effects of foreign accent incongruence is needed to understand the full range of contexts of speech comprehension in L2 that exist in the real world, including contexts where L2 speakers and listeners do not share an L1 background. Moreover, existing research on speech comprehension in L2 has assessed lexical comprehension (e.g., Hayes-Harb et al., 2008; Larraza, Samuel & Oñederra, 2016; Xie & Fowler, 2013) – with little attention paid to sentence-level comprehension, which requires the integration of multiple sources of linguistic information and may show effects distinct from those documented for lexical comprehension. Finally, previous studies have measured only behavioral indices of L2 lexical comprehension of foreign-accented speech, so possible effects of accented speech on the neural correlates of language comprehension in L2 are largely unknown. The current study directly examines L2 sentence comprehension with respect to foreign accent incongruence to shed light on these issues. Specifically, the current study addresses the aforementioned limitations of existing research by examining the neural correlates of sentence comprehension of native- and foreign-accented speech in L2, for L2 listeners who are processing sentences produced in a foreign accent that is different from that associated with their L1, i.e., Dutch L1–English L2 bilinguals who listen to Chinese-accented English sentences.

### *Event-related potentials and foreign-accented sentence comprehension*

In this study, we used the event-related potential (ERP) technique, which makes it possible to study neural activity associated with sentence processing with millisecond timing precision (for reviews, see e.g., Kaan, 2007; Swaab, Ledoux, Camblin & Boudewyn, 2012). This study tested grammar and semantic processing during sentence comprehension. ERP research on language often employs a well-established violation paradigm (Kaan, 2007) whereby the electrophysiological brain response to language errors, such as semantic anomalies or grammatical violations, is compared to correct items. This reveals information on the neural correlates of language processing.

In ERP research on language, the P600 is a common ERP effect found in response to violations of L1 grammar (e.g., Osterhout & Nicol, 1999). P600s are also reliably elicited in L2 speakers, though their elicitation seems to depend on a number of variables, such as L2 proficiency, age of acquisition, and cross-linguistic similarity (for reviews see Morgan-Short, 2014; Van Hell & Tokowicz, 2010). P600s are characterized by a posterior scalp distribution and tend to occur around 500–800 ms post-stimulus onset (i.e., after the onset of the target word). The P600 effect is generally accepted as reflecting reanalysis or repair processes during language comprehension (e.g., Kaan, 2007). In the present study, we tested grammatical processing of pronouns, which have elicited P600s in some studies (e.g., Filik, Sanford & Leuthold, 2008) but in other studies have elicited frontal negativities in the range of 270 ms–1500 ms post-stimulus (Grey & Van Hell, 2017; Nieuwland, 2014). This frontal negativity, called an Nref, is believed to reflect searching in memory for the proper antecedent or attempts at resolving referential ambiguity (e.g., Nieuwland, 2014; Van Berkum, Zwitserlood, Bastiaansen, Brown & Hagoort, 2004; note that to our knowledge the Nref has not previously been examined in L2 speakers).

With regard to semantic processing, violations of lexical/semantics (such as in example sentence 1b, see Methods) elicit a centro-parietal negativity around 300–500ms post-stimulus, termed the N400 effect. This effect is understood to reflect lexical/semantic access and integration processes (for a review see Kutas & Federmeier, 2011). While L2 grammar processing (P600s; possible Nrefs) is quite variable regarding whether L2 speakers will show L1-like ERP effects, N400s are commonly observed during L2 semantic processing (for review Bowden, Steinhauer, Sanz & Ullman, 2013).

It is only within the last 5 years that the well-established ERP correlates of sentence processing have been probed in relation to the potential effects of foreign-accented speech, and this work has only examined L1 processing – that is, a native listener processing native-accented as compared to foreign-accented sentences (Grey & Van Hell, 2017; Hanulíkova, Van Alphen, Van Goch & Weber, 2012; Romero-Rivas, Martin & Costa, 2015, 2016).

Hanulíkova et al. (2012) tested semantic and grammatical processing in native Dutch listeners during comprehension of Dutch sentences that were produced by a native Dutch accented speaker and a foreign Turkish-Dutch accented speaker. In their study, N400s to semantic

anomalies were not different in timing or magnitude between native- and foreign-accented speech, though they showed a broader distribution for Turkish-Dutch foreign-accented speech compared to native Dutch-accented speech. For grammatical processing, the authors observed P600s to Dutch agreement errors compared to correct agreement at the beginning of the experiment for only the native-accented condition. There were no ERP effects for foreign-accented grammar errors. Hanulíkova et al. (2012) interpreted the similar N400s in the two accent conditions as evidence that the effect "was not modulated by the accent of the speaker" (p. 884) and that the listeners did not experience comprehension difficulties with the foreign-accented speech. For grammar, Hanulíkova et al. (2012) concluded that the listeners' high familiarity with the Turkish-Dutch foreign accent had led them to adjust their expectations about grammatical well-formedness of Turkish-accented Dutch, since the target error examined in the study is common for Turkish-Dutch L2 speakers. Indeed, when asked to identify the foreign accent at the end of the experiment, more than 80% of the listeners correctly identified the foreign accent as Turkish.

A recent study by Grey and Van Hell (2017) also tested semantic and grammatical processing in L1 listeners. However, unlike the Hanulíkova et al. listeners, the L1 listeners in Grey and Van Hell (2017) had very little familiarity with the target foreign-accented speech condition (Chinese-accented English). Grey and Van Hell examined the processing of semantic anomalies and pronoun mismatches (i.e., grammar errors) in L1 English listeners during sentence comprehension of native American-English accented speech and foreign Chinese-English accented speech. For semantic processing, the authors observed a robust N400 in the native-accented condition, and a reduced and delayed N400 in the foreign-accented condition. For grammar, the results showed an Nref to native-accented pronoun mismatches, but no comparable ERP effects for foreign-accented pronoun mismatches. However, only 30% of these listeners were able to correctly identify the foreign accent of the study, in stark contrast to the 80% of listeners in the study by Hanulíkova et al. (2012). When the authors examined the ERP effects in more detail by dividing the L1 listeners into those who could identify the foreign accent and those who could not, a more nuanced pattern emerged for grammar processing. The listeners who could identify the foreign accent indeed showed an ERP response to foreign-accented grammar errors, though rather than an Nref the effect was more similar to an N400 response. The listeners who could not identify the foreign accent (~ 2/3 of the sample) showed no ERP effect for grammar. Results for semantic processing did not depend on accent identification. Moreover, behavioral comprehension was similarly high for both sub-groups. These findings indicate that the neural correlates of sentence processing are influenced by foreign-accented speech, and that, especially for grammar, listeners' familiarity with and knowledge about the foreign accent affect sentence processing, at least for listeners who are processing native- versus foreign-accented speech in their native language.

To our knowledge, no study has tested L2 processing of native- as compared to foreign-accented sentences using the ERP technique to assess the effects of accented speech on the neural correlates of sentence comprehension in L2. And as mentioned above, there is very little research, in general, on the effects of foreign accent incongruence on L2 processing, but such research is necessary to elucidate the full range of speech comprehension contexts in L2 that exist in communicative settings in a global society.

In the present study, we gathered ERPs during L2 processing of native- and foreign-accented sentences that were either grammatically and semantically correct, or contained errors in semantics or grammar (further design details are below). We presented these sentences to non-native English listeners (Dutch–English bilinguals) whose accent was incongruent with the target foreign-accented speech condition (Chinese-accented English). For processing of pronouns, if L2 listeners engage similar grammatical processes as L1 listeners, and their processing is not markedly affected by accentedness, then pronoun processing should show an Nref (and/or P600) for native- and foreign-accented sentences. Alternatively, if incongruent foreign-accented speech poses a significant challenge for L2 grammatical processing of pronouns (recall that L2 grammar processing has generally been found to be quite variable; for review, see Van Hell & Tokowicz, 2010), then L2 listeners may show either no ERP effects for foreign-accented speech or a qualitatively different pattern from native-accented speech, e.g., an N400-like response. For semantics, we predict that L2 listeners engage similar semantic processes as L1 listeners, as has been frequently observed in semantic processing during L2 sentence comprehension; for review, see Bowden et al. (2013). Specifically, L2 listeners are predicted to show N400s for native- and foreign-accented sentences, possibly with similar onsets for both accent conditions (as found by Hanulíkova et al., 2012), or with a delayed onset in the foreign-accented relative to the native-accented condition (as found by Grey & Van Hell, 2017).

## Methods

### *Participants*

Participants were 39 native Dutch speakers who were highly proficient in L2 English, as assessed by the tests summarized in Table 1. All were students at Radboud University Nijmegen, the Netherlands, a highly multilingual context. Fourteen participants were excluded

Table 1. *Descriptive information on the Dutch-English L2 listeners*

| $N = 25$ | *M* | *SD* | 95% CI |
|---|---|---|---|
| AoE to English | 6.44 | 1.92 | [5.64, 7.20] |
| Age of onset of English instruction (in years) | 10.56 | 1.29 | [10.12, 11.08] |
| Years of formal English study | 8.48 | 1.96 | [7.80, 9.28] |
| English verbal fluency | 38.44 | 6.90 | [35.88, 41.11] |
| Dutch verbal fluency | 49.88 | 7.32 | [47.04, 52.84] |
| English MELICET score | 42.44 | 3.86 | [40.88, 43.95] |
| Proficiency self-ratings | | | |
| English speaking | 7.28 | .98 | [6.88, 7.67] |
| English listening | 8.56 | .87 | [8.20, 8.88] |
| English reading | 8.44 | .87 | [8.08, 8.76] |
| English writing | 7.40 | .91 | [7.08, 7.76] |
| Dutch speaking | 9.72 | .46 | [9.52, 9.88] |
| Dutch listening | 9.84 | .37 | [9.68, 9.96] |
| Dutch reading | 9.76 | .44 | [9.56, 9.92] |
| Dutch writing | 9.52 | .59 | [9.28, 9.72] |

Notes. Values reported are means (M), standard deviations (SD), and [95% confidence intervals]. AoE = age (in years) of first exposure to English. Verbal fluency represents number of tokens produced in 30 seconds for each of four semantic categories. MELICET = Michigan English Language test, maximum possible score = 50. Proficiency ratings based on a scale from 1-10 where 10 = perfect.

from analysis due to excessive artifacts in the raw electroencephalogram (EEG) data (8), technical difficulty with the EEG system (3), or neuropsychological disorder (3). Therefore, data from 25 Dutch–English listeners (mean age: 21.9, *SD* = 5.1; 9 males) were analyzed. None reported a history of learning, hearing, or neuropsychological disabilities and all were right-handed as assessed by an abridged version of the Edinburgh Handedness Inventory (Oldfield, 1971).

### *Materials*

#### *Stimuli and sentence listening task*

The stimuli were the same as those used in Grey and Van Hell (2017): 240 declarative sentences that were grammatically and semantically well-formed, or matched sentences that had an error either in subject pronouns (he/she; example 1a) or semantics (i.e., were semantically anomalous; example 1b). For a complete list of the sentence stimuli see Appendix A.

(1) a. Grammar: Thomas cooked dinner last night since **he/*she** was the only person not studying.

b. Semantics: Anna stapled the entire stack of **papers/*salads** together before closing the box.

Subject pronouns were selected as the grammar target because they are a common error in Chinese–English bilinguals (e.g., see grammaticality judgments reported by Johnson & Newport, 1989), but such errors are uncommon in Dutch–English bilinguals since Dutch and English have comparable pronominal systems (e.g., Van Hell, Verhoeven, Tak & Van Oosterhout, 2005). All sentences were pre-recorded by two female speakers, one with a standard American-English accent and one with a Chinese-English accent. The speakers were chosen based on accent ratings from a separate group of 32 native English listeners living in the United States. The English accented speaker had a mean accent rating of 1.7 (*SD* = .77) on a Likert scale where *1 = no accent* and *7 = very strong accent*; the Chinese-English accented speaker had a mean accent rating of 5.6 (*SD* = .92).

During stimulus design, all sentences were normalized for intensity to 75 dB (see also Note 1).[1] For the native-accented speaker, mean sentence duration was 3234 ms (*SD* = 486, 95% CI [3190, 3277]) and for the foreign-accented speaker mean sentence duration was 4384 ms (*SD* = 791, 95% CI [4313, 4455]). These mean durations were significantly different, $F(1,479) = 765.75$, $p < .001$, $\eta_p^2 = .62$. For the grammar (pronoun) items, mean native-accented speaker pronoun duration was 117 ms (*SD* = 33, 95% CI [111, 123]) in correct sentences and mean duration in pronoun error sentences was 121 ms (*SD* = 35, 95% CI [115, 123]). Mean foreign-accented speaker pronoun duration was 233 ms (*SD* = 82, 95% CI [218, 247]) in correct sentences, and in error sentences was 234 ms (*SD* = 79, 95% CI [219, 248]). The results from an ANOVA on durations with Accent (native, foreign) and Well-formedness (correct, error) as within-subjects factors showed that foreign-accented pronouns were longer in duration than native-accented pronouns (main effect of Accent, $F(1,119) = 706.62$, $p < .001$,

[1] The main speech characteristic of interest in this study was speaker accent: native versus foreign. There are of course other variables by which speakers vary, and one of these is pitch. Speakers with higher *F0* (fundamental frequency) have been found in behavioral research to be preferred relative to lower *F0* speakers, and higher *F0* speech may be more salient than lower *F0* speech (e.g., Machado, Duarte, Teles, Reis & Rebelo, 2012; tested native listeners hearing [synthesized] native speech signals). The mean *F0* of the native-accented speaker was 192.04 (*SD* = 7.95) and the mean *F0* of the foreign-accented speaker was 196.05 (*SD* = 9.27). These pitch signals between the two speakers are descriptively highly similar, though the foreign-accented speaker's pitch is higher than the native-accented speaker, $F(1,958) = 51.830$, $p < .001$. Considering the aforementioned evidence that listeners may prefer higher-pitched signals and that these tend to be more salient, our results for foreign-accented compared to native-accented speech indicate that foreign accent has quite a powerful effect on processing, since it appears to override pitch signal preferences observed in other research. We thank an anonymous reviewer for raising this point.

$\eta_p^2$ = .85) with no other significant duration effects (Well-formedness, $p = .698$, $\eta_p^2 < .01$; Accent x Well-formedness, $p = .677$, $\eta_p^2 < .01$).

For the semantic items, spoken word frequency in American English was matched for correct and anomaly words, $F(1,239) = 2.03$, $p = .156$, $\eta_p^2 = .01$ (correct $M = 6008$, $SD = 10805$, 95% CI [4257, 8165]; anomaly $M = 3922$, $SD = 10796$, 95% CI [2230, 6111]) (Davies, 2008; The Corpus of Contemporary American English). For the native-accented speaker, mean duration for correct semantic items was 326 ms ($SD$ = 83, 95% CI [312, 342]) and for semantic errors was 387 ms ($SD$ = 91, 95% CI [371, 404]). For the foreign-accented speaker, mean duration for correct semantic items was 484 ms ($SD = 127$, 95% CI [461, 507]) and for semantic errors was 557 ms ($SD$ = 151, 95% CI [530, 584]). An ANOVA with Accent and Well-formedness as within-subjects factors showed that durations for foreign-accented semantic critical items were longer than native-accented semantic items (main effect of Accent $F(1,119) = 243.72$, $p < .001$, $\eta_p^2 = .67$) and that semantic error items tended to have longer durations than correct items (main effect of Well-formedness $F(1,119) = 36.19$, $p < .001$, $\eta_p^2 = .23$; small effect size) and no other significant duration effects (Accent x Well-formedness, $p = .548$, $\eta_p^2 < .01$). The significant differences observed for duration of native- and foreign-accented sentences and items is typical for sentences spoken by native versus non-native speakers and is an inherent aspect of foreign-accented speech (Hanulíkova et al., 2012; Romero-Rivas et al., 2015).

Correct/error and native/foreign accent sentences were distributed across four experimental lists in a Latin-square design. There were 240 sentences in each list, half spoken by the native-accented speaker and half spoken by the foreign-accented speaker. Within each speaker condition for each list, 60 sentences were correct (30 grammar condition, 30 semantics condition), 30 contained the target grammar error, and 30 had a semantic error.

During EEG recording, sentences were presented within the context of a listening task. Participants were informed they were going to listen to two people talk about their friends' lives and were introduced to the names of 10 friends (5 female, 5 male names). No mention was made of accents, grammar, or semantics. Each trial began with a 500 ms fixation cross in the center of a black screen followed by a sentence delivered bi-aurally using speakers. The fixation remained on screen during the sentence. After the sentence, participants either saw the word "Ready?" or saw a written yes/no comprehension question to which they responded via a button-box. The "Ready?" screen was intended to allow participants to rest their eyes or blink before initiating the next sentence. The questions served to measure comprehension performance and to keep participants alert during the experiment. There were 48 yes/no questions for each list; 24 for each speaker condition (for 12 no and 12 yes responses).

### *Debriefing survey*

Following the listening task, participants completed a debriefing survey that asked whether they detected a difference in the accent of the two speakers. If they selected 'no' they were prompted to submit the survey. If participants selected 'yes', they were then asked to identify the accent of each speaker. This was a 'free' response, i.e., participants could type any response. Following accent identification, they rated the degree of each accent (1–7 rating; *1 = no accent, 7 = very strong accent*) and how easy it was to understand (1–7 rating; *1 = very easy to understand, 7 = very difficult to understand*).

### *Procedure*

After providing informed consent, participants were tested in a single session lasting approximately 2.5 hours. At the beginning of the session, participants completed a background survey that assessed lifelong language experience, neuropsychological background, and sociodemographic information. After this, participants were seated in a comfortable chair in a sound-attenuated room. Participants were read aloud the instructions (in English) of the sentence listening task and completed practice prior to the experimental task. Following EEG recording, participants completed additional tasks including English and Dutch verbal fluency (Luo, Luk & Bialystok, 2010), and an English grammar test, the MELICET (see Table 1).

### *EEG acquisition and analysis*

Scalp EEG was recorded at a sampling rate of 1000 Hz from 32 Ag/AgCl active electrodes (extended 10–20 system; Jasper, 1958) mounted in an elastic cap (Brain Products ActiCap, Germany). EEG was amplified with a Brain Vision BrainAmp system (Brain Products, Germany); it was filtered online with a .016-250 Hz bandpass filter and off-line with a 30 Hz half-amplitude low-pass filter (24dB/octave roll-off). Scalp electrodes were referenced online to a vertex reference and re-referenced off-line to the average of activity from the left and right mastoids. Additional electrodes were placed above and below the left eye and at the outer canthus of each eye, referenced in bipolar montages, in order to monitor ocular movements. Impedances were kept below 10kΩ.

ERPs were time-locked to the onset of the critical word for each sentence (the bolded words in example 1) and averaged off-line for both linguistic target conditions in each participant (200ms pre-stimulus baseline) within each accent condition. Data free of ocular and muscle

artifacts were included in the analyses. Informed by previous research and visual evidence from the ERP waveforms, we selected the common time-windows for capturing the ERP effects of interest in this study: Nref, N400, P600. A time-window of 250–500 ms was selected to capture N400 and Nref effects (e.g., Nieuwland, 2014; Osterhout & Nicol, 1999) and a time-window of 500–800 ms was selected due to the sustained character of Nrefs and to capture P600 effects (e.g., Grey, Tanner & Van Hell, 2017; Grey & Van Hell, 2017; Nieuwland, 2014), which as reviewed above have occasionally been elicited for pronoun mismatches. Data from the scalp electrodes were grouped into three distributional regions – anterior (Fz, F3, F4, FC5, FC6), central (Cz, C3, C4, CP1, CP2), and posterior (Pz, P3, P4, P7, P8) (for similar approaches see Grey et al., 2017; Hanulíkova et al., 2012; Romero-Rivas et al., 2015). Following Grey and Van Hell (2017), mean ERP amplitudes were entered into separate ANOVAs for each time window and linguistic target, with Accent (native, foreign), Well-formedness (correct, error), and Distribution (anterior, central, and posterior) as within-subjects factors. Follow-up analyses were conducted testing a priori hypotheses for the factors Accent and Well-formedness.

## Results

### *Sentence comprehension*

Listeners showed high comprehension accuracy, $M = .85$, $SD = .07$. Accuracy was high in both the native English and foreign Chinese-English accent conditions ($M = .90$, $SD = .07$ and $M = .81$, $SD = .11$, respectively), but was significantly higher for native-accented sentences in a two-tailed *t*-test by participants and by items ($t1(24) = 4.15$, $p < .001$; $t2(95) = 4.23$, $p < .001$).

### *ERPs*

#### *Grammar*

ERP waveforms for pronoun grammar processing in the native accent and foreign accent conditions are presented in Figures 1 and 2, respectively, and the corresponding topographical voltage maps of both conditions are presented in the top panel of Figure 3. Visual inspection suggested that pronoun mismatches elicited an Nref in the native accent condition (see Figure 1), and no effects in the foreign-accented condition (see Figure 2). The results from the global ANOVA in the 250–500ms time window produced no significant main effects or interactions: main effect of Accent, $p = .257$; main effect of Well-formedness, $p = .152$; Accent x Well-formedness, $p = .182$; Accent x Well-formedness x Distribution, $p = .444$. The results from the 500–800 ms time-window produced a significant main effect of Accent, $F(1,24) = 7.585$, $p = .011$, $\eta_p^2 = .24$, due to ERPs in the foreign accent condition being more positive than ERPs in the native accent condition (foreign $M\ \mu V = 1.327$, $SE = .320$; native $M\ \mu V = .414$, $SE = .188$), but there were no significant main effects or interactions with Well-formedness (main effect of Well-formedness, $p = .400$, Accent x Well-formedness, $p = .328$, Accent x Well-formedness x Distribution, $p = .714$).

To test the a priori hypotheses for differences in native and foreign-accented grammar processing in L2, we also conducted separate analyses within each accent condition for the two time-windows, with Well-formedness and Distribution as within-subjects factors. In the 250–500 ms window, the results showed a main effect for Well-formedness in the native accent condition, $F(1,24) = 5.18$, $p = .032$, $\eta_p^2 = .18$, as a result of pronoun mismatches (i.e., errors) eliciting more negative ERPs than pronoun matches (native accent mismatch $M\ \mu V = .127$, $SE = .260$; native accent match $M\ \mu V = 1.044$, $SE = .304$). In the foreign accent condition there was no significant main effect of Well-formedness ($p = .821$) and no interaction with Well-formedness ($p = .915$). There were no significant main effects or interactions in either accent condition separately in the 500–800 ms window (native accent main effect of Well-formedness, $p = .195$, Well-formedness x Distribution, $p = .574$; foreign accent main effect of Well-formedness, $p = .805$, Well-formedness x Distribution, $p = .749$).

These analyses confirmed an Nref in the native accent condition, but no significant effect in the foreign accent condition.

#### *Semantics*

ERP waveforms for semantic processing in the native accent and foreign accent conditions are presented in Figures 4 and 5, respectively, and the corresponding voltage maps are presented in the bottom panel of Figure 3. Visual inspection suggests that semantic errors produced an N400 with a delayed onset in both accent conditions (see Figures 4 and 5). ANOVAs confirmed this. In the 250–500 ms time-window, there were no significant effects: main effect of Accent, $p = .829$; main effect of Well-formedness, $p = .650$; Accent x Well-formedness, $p = .663$; Accent x Well-formedness x Distribution, $p = .890$. This indicates there were no differential ERP responses to semantic errors in this time-window, where N400 effects are commonly observed. This was also the case when each accent condition was analyzed separately (native accent main effect of Well-formedness, $p = .550$, Well-formedness by Distribution, $p = .759$; foreign accent main effect of Well-formedness, $p = .960$, Well-formedness x Distribution, $p = .495$).

In the 500–800 ms time-window there was a significant main effect of Well-formedness, $F(1,24) = 7.299$,

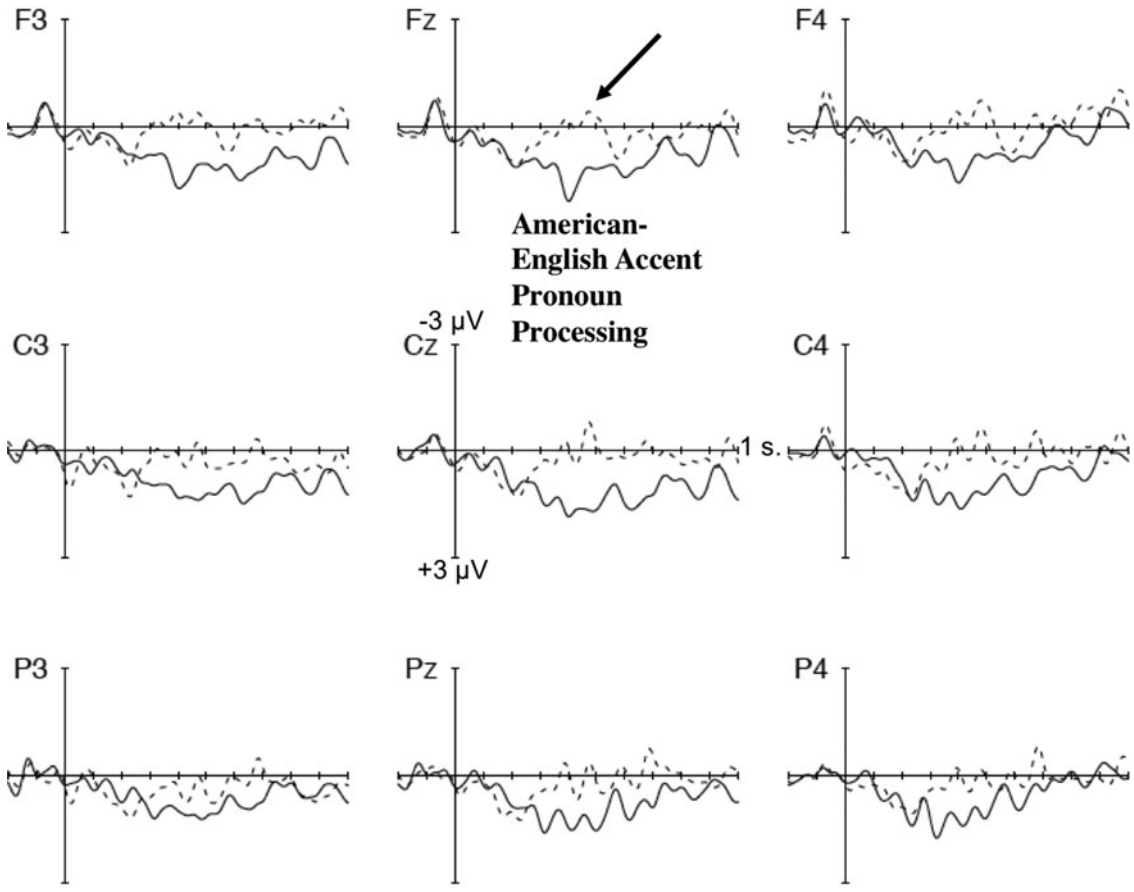


Figure 1. Grand mean ERP waveforms for nine representative electrodes for pronoun processing of native American-English accented speech. Waveforms represent activity for correct pronoun (solid line) and pronoun error (dashed line) conditions. Each tick mark represents 100 ms; negative voltage is plotted up. These and all subsequent waveforms were filtered with a 15 Hz low-pass filter for presentation purposes only. The black arrow indicates the Nref effect.

$p = .012$, $\eta_p^2 = .23$, due to semantic errors eliciting more negative ERPs than correct semantics (error $M$ $\mu$V = –.644, $SE$ = .283; correct $M$ $\mu$V = .217, $SE$ = .202), suggestive of an N400 with a late onset. Semantic errors elicited more negative ERPs than correct semantics for both native-accented and foreign-accented speech in this time window (native accent error $M$ $\mu$V = −.633, $SE$ = .388; native accent correct $M$ $\mu$V = .194, $SE$ = .386; foreign accent error $M$ $\mu$V = −.655, $SE$ = .329; foreign accent correct $M$ $\mu$V = .240, $SE$ = .288). There was no significant main effect of Accent ($p$ = .973) nor significant interactions with Accent (Accent x Well-formedness, $p$ = .929; Accent x Well-formedness x Distribution, $p$ = .876). Analyses within each accent condition showed that the effect of Well-formedness did not reach significance separately in the two conditions (native accent $p$ = .126, $\eta_p^2$ = .095; foreign accent $p = .064$, $\eta_p^2 = .14$). Thus, over BOTH accent conditions, semantic errors elicited a small but significant N400 effect with a delayed onset.

### *Debriefing*

The debriefing survey revealed that 100% of the Dutch–English listeners detected a difference in the accents. The debriefing also showed that many (44%) of the listeners believed the accents reflected regional or dialect accent differences in English, such as American-English versus Scottish-English, rather than identifying native- versus foreign-accented English. In fact, only 16% of the listeners differentiated the two accents as representing native versus foreign English and, of those, half (i.e., 8% of all listeners) correctly identified the Chinese-English accent.

Recall that participants were also asked to provide ratings for the degree of accentedness and comprehensibility of each accent (i.e., how easy it was to understand). As could be expected, the listeners rated the Chinese-English (foreign) accent as having a higher degree of accentedness than the American-English (native) accent, $t(24) = 6.063$, $p < .001$ (American-English accent rating M = 3.04, $SD$ = 1.54;

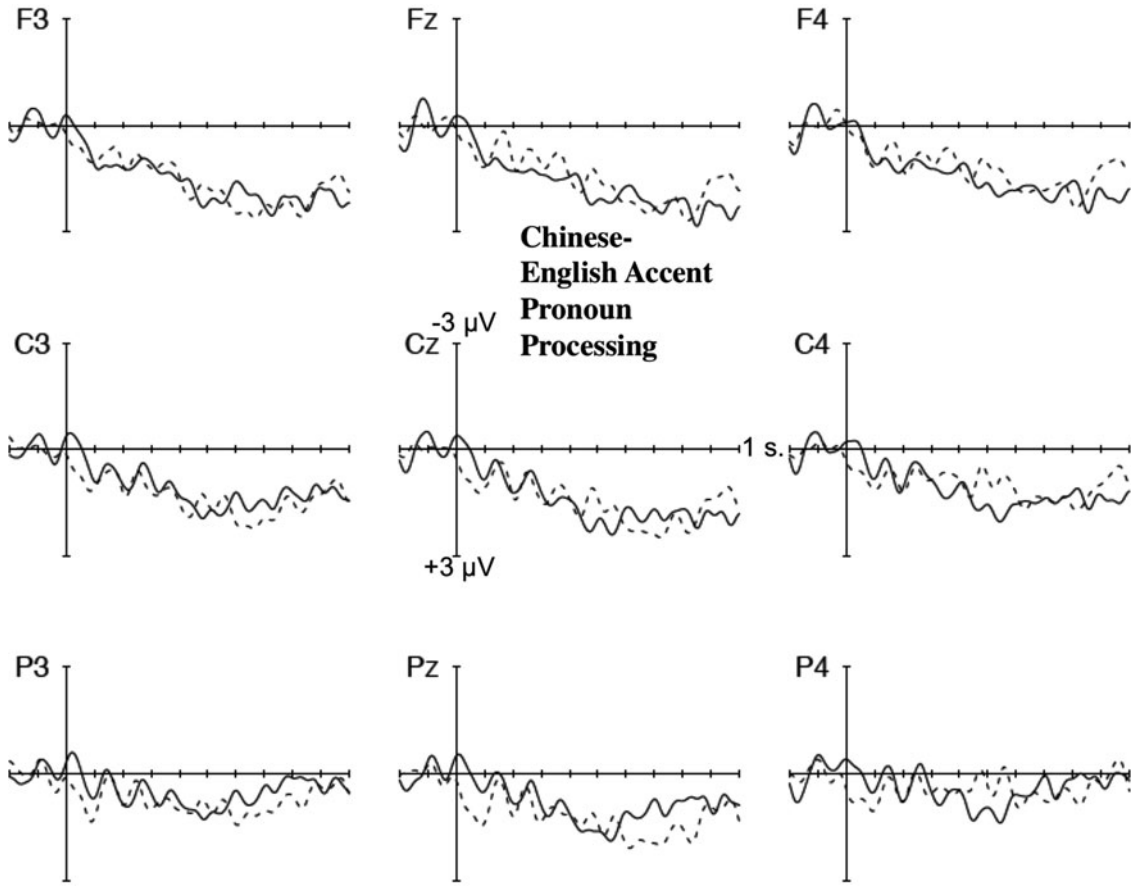


Figure 2. Grand mean ERP waveforms for nine representative electrodes for pronoun processing of foreign Chinese-English accented speech. Waveforms represent activity for correct pronoun (solid line) and pronoun error (dashed line) conditions. Each tick mark represents 100 ms; negative voltage is plotted up.

Chinese-English accent rating M = 5.68, *SD* = 1.21). The listeners also rated the Chinese-English accent as being less comprehensible than the American-English accent, $t(24) = 3.951$, $p = .001$ (American-English rating $M = 2.48$, $SD = 1.81$; Chinese-English accent rating $M = 4.68$, $SD = 1.31$). These ratings reinforce the notion that non-native speech (i.e., the Chinese-English accent tested here) tends to induce intelligibility and comprehension difficulties in listeners (e.g., Munro & Derwing, 1995a, 1995b), and replicate the debriefing outcomes from the native English listeners tested in Grey and Van Hell (2017).

## Discussion

This study used ERPs to examine neural correlates of L2 processing of grammar and semantics in native- and foreign-accented speech, for a foreign accent that was different from the L2 listeners' own accent in the L2. To our knowledge, this is the first study to examine this issue at the sentence level.

Results for behavioral sentence comprehension showed that the Dutch–English listeners' comprehension accuracy was high for both accent conditions, but they responded more accurately to native American-English accented than to foreign Chinese-English accented sentences. This matches findings that have been observed for native listeners (e.g., Grey & Van Hell, 2017) and fits with other evidence that foreign-accented speech tends to produce comprehension difficulty (e.g., Munro & Derwing, 1995a). Considering the high L2 proficiency of the participants (see Table 1), the finding is also in line with recent research showing that, perhaps counter-intuitively, greater relative difficulty in understanding foreign-accented speech may be an indicator of higher L2 proficiency, at least for L2 listeners who are processing a foreign accent different from their own (Lev-Ari et al., 2017; note that they tested lexical identification).

The ERP results for grammatical processing showed an Nref effect in response to pronoun mismatches only for the native-accented condition, and not for the foreign-accented condition. From the perspective that Nrefs

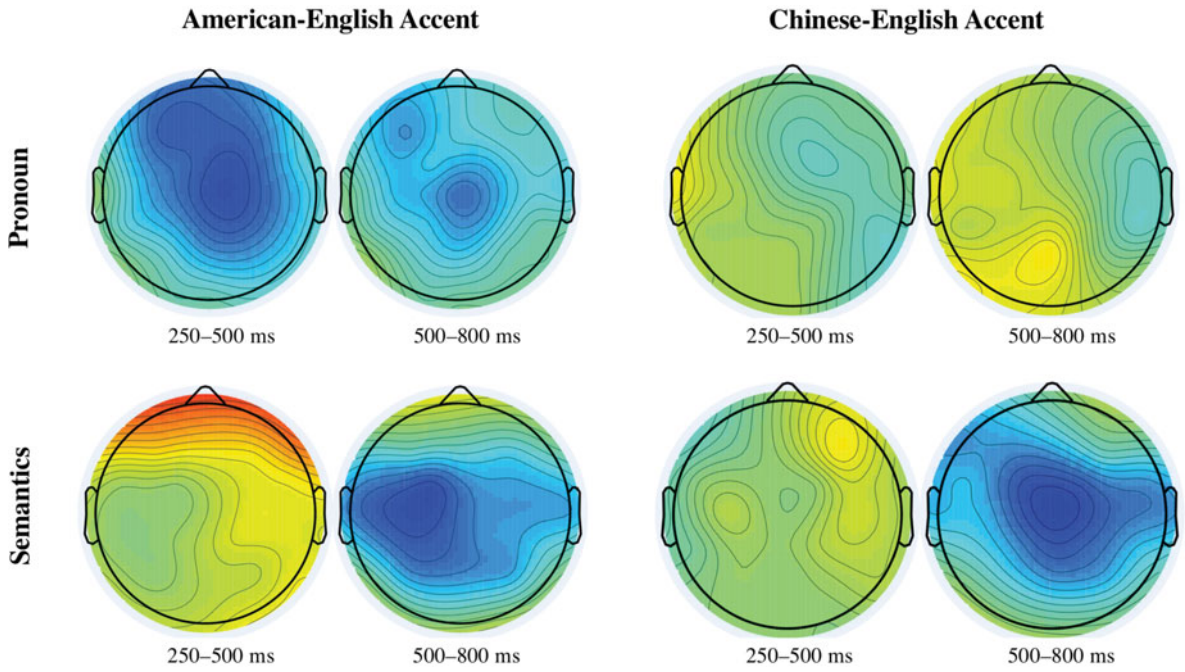


Figure 3. (Colour online) Topographical maps show the scalp distribution of activity in the pronoun grammar error minus its matched correct condition and the semantic error minus its matched correct condition for the two accent conditions. Activity is averaged for the 250–500 ms and 500–800 ms time windows. Calibration scale is $\pm 2\mu$V.

reflect a search in memory for the proper antecedent when the antecedent is missing (e.g., Nieuwland, 2014; Van Berkum, Brown, Hagoort & Zwitserlood, 2003), the present findings for the L2 listeners indicate that they initiated an antecedent search when encountering the mismatching pronoun in the native-accented L2 sentences, but not in the incongruent foreign-accented L2 sentences. One interpretation of this set of results is that rather than engaging in detailed grammatical processing of the foreign-accented sentences, the L2 listeners employed a 'good enough' processing strategy instead (e.g., Ferreira & Patson, 2007), which still allowed them to achieve high comprehension accuracy. This 'good enough' processing strategy may have been uniquely cued by the foreign-accented speaker identity (e.g., Bosker, Quené, Sanders & de Jong, 2014), and notably matches the results observed in L1 listeners in Grey and Van Hell (2017).

ERP research on L2 grammatical processing (mostly focusing on the written modality rather than the auditory modality as tested here) shows that L2 participants are highly variable in whether they show L1-like ERP responses to grammatical violations, often as a function of L2 proficiency (Ojima, Nakata & Kakigi, 2005), type of language exposure (Batterink & Neville, 2013; Morgan-Short, Steinhauer, Sanz & Ullman, 2012), and cross-language similarity (Tolentino & Tokowicz, 2011). The L2 listeners in this study indeed showed an L1-like ERP pattern for L2 grammar processing as evidenced by the Nref observed for native-accented speech. Notably, the current results reveal that, within the same group of L2 listeners, incongruent and unfamiliar foreign-accented speech constitutes an important additional source of variability in the elicitation of ERP effects. Future research with other bilingual groups and grammatical targets will help to further generalize, or constrain, the present findings for differential L2 processing of native- versus foreign-accented grammar during online sentence comprehension. Regarding research with other bilingual groups, it will also be important to consider the influence of L2 immersion. The bilinguals in the present study were tested in an L1 environment and bilinguals who are immersed in the L2 environment may show different results for the processing of native- and (congruent or incongruent) foreign-accented speech.

In contrast to grammar, the results for semantics showed a similar ERP pattern for native- and foreign-accented speech: an N400 effect. However, the N400 component was significantly delayed relative to standard L1 results. It is interesting that the N400 in this study showed a delayed onset but the Nref – found only for the native accent condition – did not. Recall that the pronoun in each sentence was co-indexed (either correctly or incorrectly) with a male or female name introduced at the beginning of the sentence (see example 1a in Methods and Appendix A). One possibility is that this boosted the referential information that could be used by the L2 listeners to process upcoming pronouns during

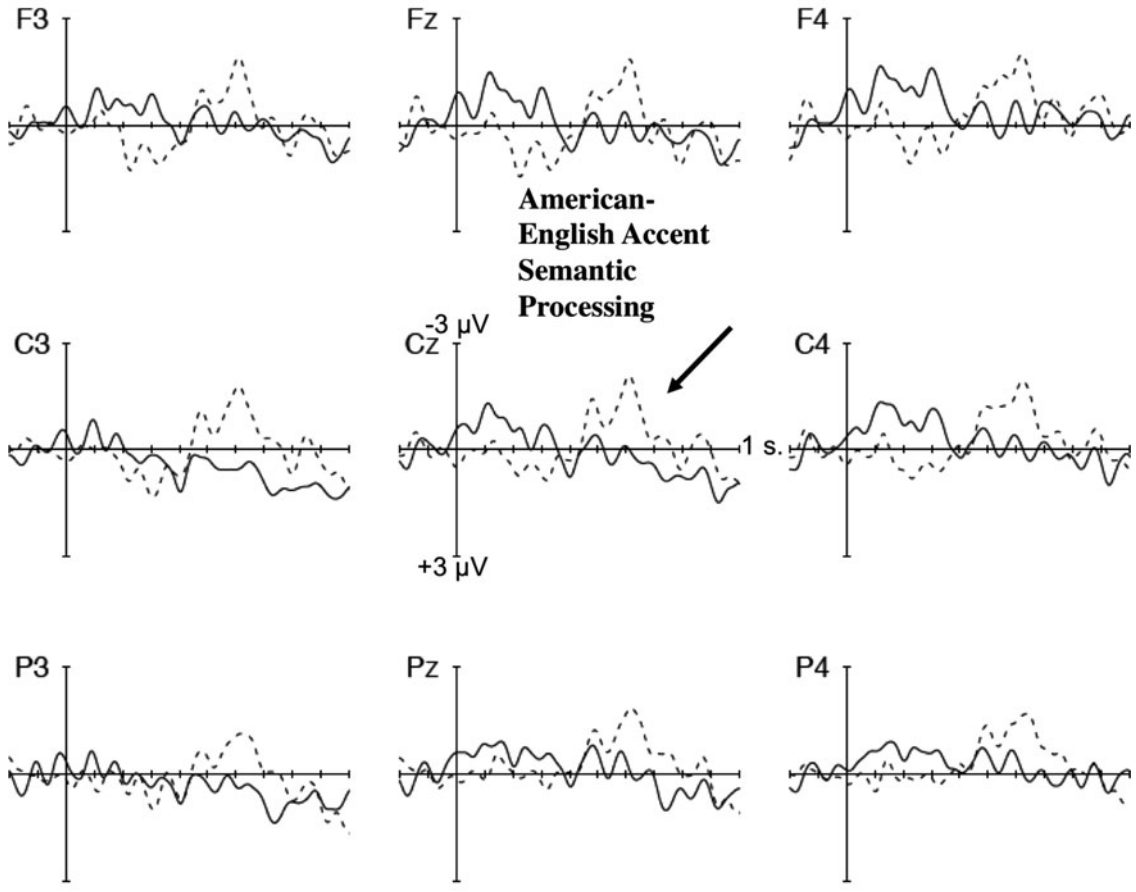


Figure 4. Grand mean ERP waveforms for nine representative electrodes for semantic processing of native American-English accented speech. Waveforms represent activity for correct semantics (solid line) and semantic error (dashed line) conditions. Each tick mark represents 100 ms; negative voltage is plotted up. The black arrow indicates the delayed-onset N400 effect.

sentence comprehension. For example, hearing the name *Thomas* may have boosted referential information for male pronouns such as *he*, *him*, *his*. This may have made incorrect (mismatching) pronouns even more salient, thus eliciting the Nref, at least for the native-accented speech. Semantics, on the other hand, was not tied to this limited set of grammatical gender information to potentially help boost (or predict) upcoming information that could be useful for listeners during sentence processing. Although one of the primary goals of the study was to test the effects of accent on semantic processing and not, for example, the semantic predictability of sentences, an interesting path for future research would be to examine how variation in the semantic predictability of L2 sentences affects the comprehension of foreign-accented and native-accented speech (see also Schertz & Hawthorne, 2018).

More generally, the delayed nature of the N400 here aligns with the small amount of ERP research on L2 semantic processing in sentence contexts, which shows that semantic errors tend to elicit N400s that are delayed or reduced in amplitude (for a review see Bowden et al., 2013). Delayed N400 effects may be due to slower or less efficient lexical-semantic processing in the L2 (for discussion, see Mueller, 2005). An alternative interpretation of the delayed negativity is that it is indexing conceptual rather than lexical processing of the semantic error, as suggested by Hahne and Friederici (2001). They hypothesize that the N400 indexes lexical/semantic integration, and that the later negativity indexes that semantic integration processes at the lexical level are supplemented in the L2 by semantic mapping between prior contextual information and the target error at a conceptual level.

The present study examined a further level of L2 semantic processing by investigating the effects of a native and foreign accent on processing. In this context of accented speech and L2 semantic processing, it is of note that the N400 effect was similar across both foreign- and native-accented speech conditions. This result makes sense in light of the results for accent identification on the debriefing questionnaire. By and large, the L2 listeners believed they were listening to regional variants of native English, as opposed to native- versus foreign-accented English. In a study with native listeners, Goslin, Duffy, and

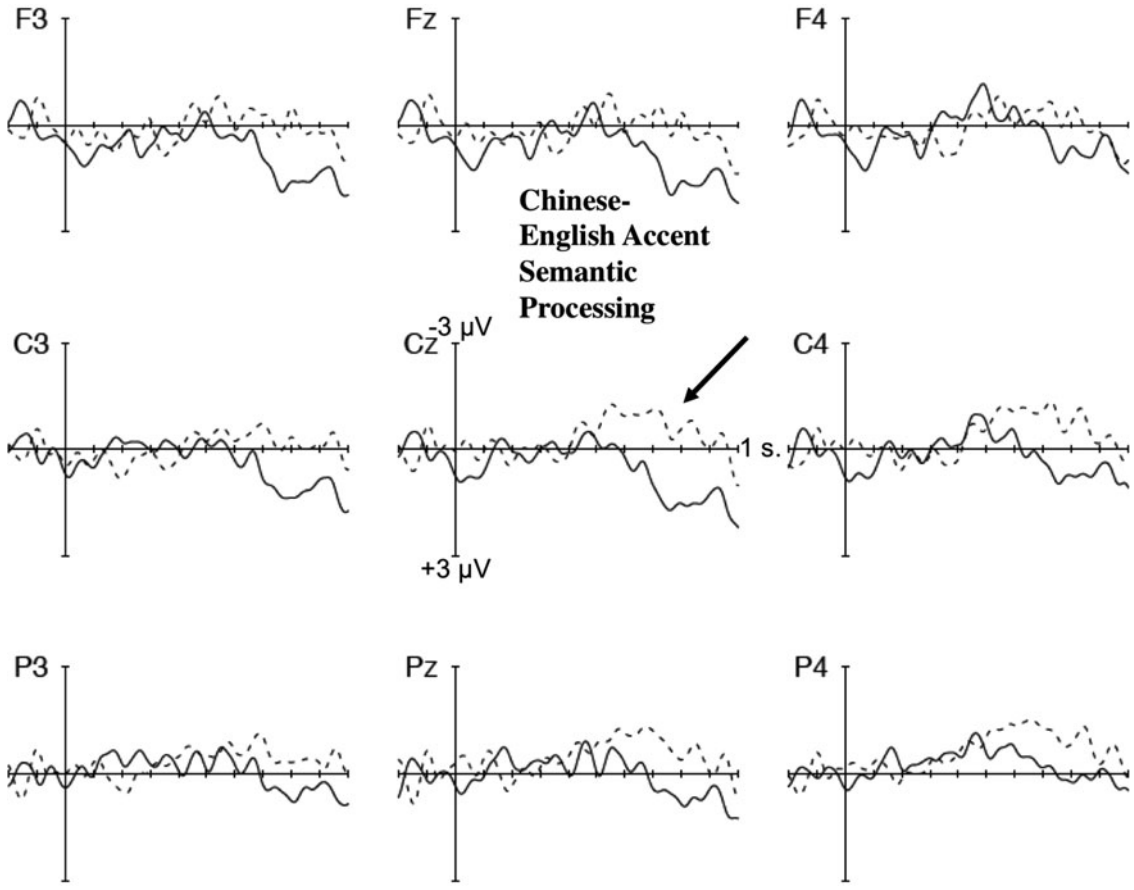


Figure 5. Grand mean ERP waveforms for nine representative electrodes for semantic processing of foreign Chinese-English accented speech. Waveforms represent activity for correct semantics (solid line) and semantic error (dashed line) conditions. Each tick mark represents 100 ms; negative voltage is plotted up. The black arrow indicates the delayed-onset N400 effect.

Floccia (2012) observed similar N400s during semantic processing of different regional accents. Our findings of similar N400s in the present study align well with that work, given that many of the L2 listeners in this study believed they were processing different regional accents. The limited ability of the L2 listeners to identify the accent contrasts with research on L1 listeners, who generally show high ability to distinguish native from foreign accentedness (e.g., Hanulíkova & Weber, 2012) even if precise identification of the foreign accent is variable among L1 listeners (e.g., Grey & Van Hell, 2017). However, the present debriefing result aligns well with work on foreign accent perception and intelligibility in L2, which has found that L2 listeners do not uniformly perceive strong accent differences between foreign- and native-accented speech (e.g., Munro, Derwing & Morton, 2006), especially for accents they are unfamiliar with (e.g., Witteman, Weber & McQueen, 2013).

The observation that the N400 for semantic processing had a delayed onset, in both native-accented and foreign-accented speech, is also of note. This finding is different from the findings for L1 listeners in Grey and Van Hell (2017), who were tested on the exact same materials. The L1 listeners in that study showed a delayed N400 to foreign-accented speech, but they showed a classically-timed N400 for native speech. Linking the results of the current study with prior work suggests that a key factor for the time-course of semantic processing during accented speech comprehension may be FAMILIARITY with the accent, rather than nativeness versus foreignness *per se* (see also e.g., Larraza & Best, 2017; Porretta, Tremblay & Bolger, 2017; Van Heugten & Johnson, 2014 for recent work on lexical-level processing and accent familiarity). For example, Hanulíkova et al. (2012) observed classically-timed N400s for both native- and foreign-accented semantic processing in L1 listeners who were highly familiar with the foreign accent. Grey and Van Hell (2017) observed classic N400 timing in the native-accented condition in L1 listeners who were explicitly recruited to have limited experience with foreign-accented speech, and the listeners exhibited a delayed N400 for the foreign accent. The debriefing information in the current study showed that most of the L2 listeners thought they listened to regional variants

of English, which indicates that they were not familiar enough with the distinction between native-accented (American-English) speech and unfamiliar, incongruent foreign-accented (Chinese–English) speech, resulting in the delayed time-course of the N400 observed over both accent conditions.

Another possibility is that although L2 listeners are highly capable of understanding the accented speech, as evidenced by their high comprehension accuracy (similar to L1 listeners confronted with a foreign accent), they are not able to do so in exactly the same way as L1 listeners. Thus, they experience a delayed time-course for semantic processing across both native and foreign accents. Further research on the effects of accentedness and accent familiarity on L2 processing of semantics during sentence comprehension will shed light on these possibilities.

To conclude, the current study's examination of L2 processing of native-accented and unfamiliar foreign-accented sentences provides novel insights into the real-time processing of accented speech in L2 listeners. The study demonstrates differential grammatical processing of native-accented compared with foreign-accented speech (i.e., an Nref vs. no effect) which paralleled ERP results observed in L1 processing (Grey & Van Hell, 2017). It also demonstrates similar semantic processing in the two accent conditions (delayed N400 in both cases) which differed from results observed in L1 processing of the same sentences (Grey & Van Hell, 2017). With worldwide multilingualism and increasing globalization, L2 speaker-listeners are frequently in communicative contexts where they are processing a variety of foreign accents. The present findings show that these communicative contexts induce differential patterns of processing for L2 grammar and semantics of native-accented and unfamiliar foreign-accented L2 sentences, and suggest an important role for the L2 listener's familiarity with the accent.

## Appendix A

Sentence stimuli. Target words are in bold, * indicates the pronoun mismatch or semantically anomalous word. See Grey and Van Hell (2017) for further details.

### Pronoun

Peter wanted to skip gym class because **he/*she** had a hurt ankle.

John was confused about the rent notice because **he/*she** had already mailed the check.

Thomas was carrying several bottles of water because **he/*she** would be hiking for a long time.

Richard wanted to wake up early to work out because **he/*she** knew the meeting would be long.

Kevin thought it had rained because **he/*she** could see puddles in the yard.

Peter was late for math class because **he/*she** woke up later than expected.

John had to attend the meeting because **he/*she** wanted a position on the board.

Thomas thought the race was over because **he/*she** saw people cheering in the crowd.

Richard borrowed the book from the library because **he/*she** wanted to read ahead.

Kevin walked to school early because **he/*she** wanted to avoid the rain.

Peter did not want to cancel the visit to the doctor but **he/*she** had an exam that day.

John did not wake up early to study but **he/*she** received a high grade anyway.

Thomas would feel more confident but **he/*she** received a bad review.

Richard returned the books but **he/*she** still owed a late fee.

Kevin wanted to travel to Europe but **he/*she** was not sure there would be time.

Peter wanted to eat dinner but **he/*she** needed to finish the essay.

John was proud after seeing the test score but **he/*she** knew it could have been higher.

Thomas was planning to attend the meeting but **he/*she** missed the bus to school.

Richard normally eats smaller meals but **he/*she** was very hungry after working out.

Kevin spilled a bowl of soup but **he/*she** mopped the floor.

Peter won an award at the end of the game since **he/*she** scored three out of the five goals.

John went to the dentist today since **he/*she** felt a loose tooth last night.

Thomas went to the mall after class since **he/*she** wanted to buy new pants.

Richard decided not to go to practice since **he/*she** was not feeling well.

Kevin went to the car wash since **he/*she** had the afternoon free.

Peter ran home after band practice since **he/*she** still had a lot of energy

John did not want to attend social studies since **he/*she** forgot to finish the homework.

Thomas cooked dinner last night since **he/*she** was the only person not studying.

Richard had the desk repaired since **he/*she** knew the owners loved it.

Kevin sat in a desk closer to the front since **he/*she** forgot to bring glasses.

Peter drank a lot of coffee because **he/*she** could not stay awake.

John won the contest because **he/*she** had a lot of support.

Thomas had trouble following the strict diet because **he/*she** loved eating ice cream.

Richard likes studying in the morning because **he/*she** is the only one up at that time.

Kevin played video games all day because **he/*she** did not have to go to school.

Peter decided to go fishing because **he/*she** never went as a kid.

John went camping with the family because **he*/she** was going to be in town.

Thomas retook the exam because **he/*she** did not like the grade.

Richard decided to rent out the apartment because **he/*she** would be traveling all summer.

Kevin wanted to eat an early lunch because **he/*she** knew there would not be time later on.

Peter was having trouble seeing but **he/*she** had just gotten new glasses.

John did not think anyone would attend the ceremony but **he/*she** saw close friends in the crowd.

Thomas was excited about the concert but **he/*she** knew it would take time from his studying.

Richard would have called the hotel but **he/*she** forgot to charge the phone last night.

Kevin was sick but **he/*she** decided to play the game anyway.

Peter had a lot of homework but **he/*she** was still in a very good mood.

John wanted to eat dinner downtown but **he/*she** could not find the time.

Thomas was supposed to be at the party but **he/*she** decided to go to the movies.

Richard did not to want attend the show alone but **he/*she** was the only one free that night.

Kevin wanted to skip the meeting but **he/*she** had to give a presentation.

John wore contacts today since **he/*she** had an important interview.

Thomas bought two tickets for the theater since **he/*she** had a friend visiting.

Richard played the music loud since **he/*she** had a hearing problem.

Kevin went to bed late since **he/*she** did not have class in the morning.

Peter went shopping since **he/*she** needed new clothes and shoes.

John asked for a glass of water since **he/*she** had eaten a lot of salty popcorn.

Thomas walked to the market since **he/*she** wanted more exercise.

Richard could not go to the festival since **he/*she** forgot to buy tickets.

Kevin failed the class since **he/*she** stopped attending lectures.

John went to the emergency room since **he/*she** was still feeling sick.

Mary wanted to skip dance class because **she/*he** had a severe headache.

Emily was worried about the job interview because **she/*he** still had a sore throat.

Anna was hoping to turn the paper in on time because **she/*he** needed a good grade.

Kaitlyn wanted to go to sleep early because **she/*he** had an 8 a.m. workshop.

Megan thought it had rained because **she/*he** saw water spots on the car.

Mary was worried about the presentation because **she/*he** was not prepared.

Emily was unsure about the answer because **she/*he** did not read the textbook.

Anna was excited to check the mail because **she/*he** was receiving a package today.

Kaitlyn was absent from school because **she/*he** was sick with the flu.

Megan enjoyed traveling to Europe because **she/*he** could try new foods.

Mary was excited to go home but **she/*he** would also miss spending time on campus.

Emily thought the paper was challenging but **she/*he** agreed the topic was fair.

Anna had planned to wear sandals but **she/*he** realized it would be rainy.

Kaitlyn was tired of doing homework but **she/*he** would be too busy to finish tomorrow.

Megan would shop online but **she/*he** likes to try on the clothes.

Mary did not want to appear on TV but **she/*he** had agreed to be a guest.

Emily had been optimistic about the exam but **she/*he** received quite a low score.

Anna normally enjoyed walking home but **she/*he** was very tired from gym.

Kaitlyn usually liked going to work but **she/*he** was in trouble with management.

Megan likes the new school but **she/*he** has trouble passing the exams.

Mary went to the pageant since **she/*he** wanted to support the girls.

Emily exchanged the gift since **she/*he** did not like the color.

Anna went to the hospital since **she/*he** was not feeling well.

Kaitlyn fundraised for the European trip since **she/*he** could not afford the cost alone.

Megan was sure to be accepted in the program since **she/*he** met all the criteria.

Mary slept an extra hour since **she/*he** did not have class until much later.

Emily was worried about the exam grade since **she/*he** did not know the answer to several questions.

Anna requested a tutor since **she/*he** was failing the class.

Kaitlyn played the entire game because **she/*he** wanted to take the trophy home.

Megan took a long bath since **she/*he** was sore from practice.

Mary got the answers wrong because **she/*he** switched the questions around.

Emily decided to lose weight because **she/*he** wanted to fit in the dress.

Anna did not want to see the movie because **she/*he** heard it was boring.

Kaitlyn rode the bus to work because **she/*he** did not want to pay for gas.

Megan studied all night because **she/*he** had a test the next morning.

Mary ended the relationship because **she/*he** did not feel good about it anymore.

Emily was fired from the job because **she/*he** skipped three days of work.

Anna cleaned the house because **she/*he** wanted to impress everyone.

Kaitlyn disliked going to camp because **she/*he** did not like the mosquitoes.

Megan apologized to the group because **she/*he** was wrong about the due date.

Mary knew there were several weeks until the trip but **she/*he** was already very excited.

Emily lost the keys yesterday but **she/*he** was able to get in the house.

Anna does not usually take the scenic route **but/*he** she wanted to see the mountains.

Kaitlyn did not have class in the morning but **she/*he** woke up early anyway.

Megan does not like cleaning but **she/*he** will be having visitors tonight.

Mary wanted to finish the marathon but **she/*he** began to cramp half way through.

Emily was sore from running but **she/*he** still attended yoga class

Anna was normally confident but **she/*he** was nervous about the presentation.

Kaitlyn needed a break from work but **she/*he** could not take a vacation.

Megan could have worked at home but **she/*he** needed a color printer.

Mary took a different route to school since **she/*he** wanted a change of scenery.

Emily went to the store since **she/*he** forgot to buy eggs.

Anna was unable to finish the documentary since **she/*he** did not pay the internet bill.

Kaitlyn arrived early to the park since **she/*he** was hosting the yearly picnic.

Megan cooked spaghetti since **she/*he** had the evening free.

Mary worked extra hours since **she/*he** needed more money for bills.

Emily was not surprised by the job offer since **she/*he** had excellent references.

Anna decided to get a new haircut since **she/*he** had several upcoming interviews.

Kaitlyn felt left out of the conversation since **she/*he** had to skip going to the play.

Megan canceled going to camp since **she/*he** would be taking extra classes.

### Semantics

Mary baked a cake with walnuts and **berries/*teacups** because it was the teacher's favorite.

Emily has a record marathon time of two **hours/*tablecloths** and twenty minutes.

Anna was happy she remembered to water the **plants/*lamps** and flowers before work.

Kaitlyn went on a brisk thirty-minute **walk/*pillow** every morning last week.

Megan was thirsty and drank a bottle of **water/*sand** before working out.

Peter had fun on the trip but spent almost a thousand **dollars/*puppets** on all the food and drinks.

John spent the entire weekend writing thank you **cards/*candlesticks** to the guests from the party.

Thomas quoted the secretary and the **supervisor/*toothbrush** in the weekly project report.

Richard ate a bagel with **jelly/*telephone** and butter for lunch.

Kevin proclaimed his innocence and denied the **lies/*potatoes** that had been written about him.

Mary sent two signed copies of the **contract/*turtle** to the main office.

Emily's wristwatch stopped working and needed **batteries/*tomatoes** before her vacation.

Anna stapled the entire stack of **papers/*salads** together before closing the box.

Kaitlyn suspected that the bird food had been eaten by the **squirrels/*notebooks** that she saw outside last night.

Megan gave the dirty dog a **bath/*computer** to get rid of the mud.

Peter ate a very spicy taco and his **mouth/*trophy** was still burning.

John drank an entire **bottle/*keyboard** of water after his long run.

Thomas had an interview and made sure to iron the **suit/*yogurt** before going to sleep.

Richard parked the **van/*shampoo** near the building entrance.

Kevin loved the band and had heard all of their **albums/*pancakes** at least twenty times.

Mary was upset with the store and wrote a long email to the **manager/*elevator** to complain about the clerk.

Emily had lost weight and could wear all of the **dresses/*brooms** she saw in clothing stores.

Anna helped plant new flowers and **bushes/*lipstick** in the front and back yard.

Kaitlyn has worked out in the gym five **days/*carpets** a week since college

Megan needed to know if the pizza sauce had **oregano/*mittens** in it since she was allergic.

Peter fixed his hair with a **comb/*zucchini** because it had grown long.

John walked a long way to **work/*briefcase** in the mornings for exercise.

Thomas read a **story/*carrot** about a man going on an adventure

Richard planted **potatoes/*refrigerators** and cabbage in his green house.

Kevin had fun playing on the **swingset/*grapefruit** and sliding down the slide.

Mary thought it was nice outside and opened the **window/*lightbulb** to let fresh air in.

Emily crumpled up the latest draft of the **essay/*moustache** after writing it for hours.

Anna saw the spilled wine and mopped the **kitchen/*elephant** so nobody would slip.

Kaitlyn raked all the **leaves/*pockets** in the front yard Wednesday.

Megan was craving Italian food and wanted to eat **spaghetti/*driveways** for dinner this weekend.

Peter had a thirty-minute break so he walked around the **park/*account** to get some fresh air.

John swam in the **lake/*nickel** every day last summer.

Thomas saw the roads were slippery so he gripped the **wheel/*bee** tightly to avoid losing control.

Richard had a cold and blew his **nose/*table** with a handkerchief.

Kevin need to tie the wood together so he used a **rope/*zoo** that was bought last winter.

Mary listened to the **teacher/*napkin** lecture about ancient civilizations.

Emily knitted the **sweater/*brick** with different colors.

Anna framed the **photo/*mist** and hung it on her living room wall.

Kaitlyn flushed the paperwork down the **toilet/*factory** by complete accident.

Megan grabbed an envelope and sealed the **letter/*fire** firmly with wax.

Peter used the knife to spread **butter/*magazine** on his English muffin.

John spilled a little bit of **coffee/*cathedral** on the brand new carpet.

Thomas felt a terrible amount of **pain/*folder** in his stomach yesterday.

Kevin tipped the **waiter/*volcano** twenty percent after paying the bill.

Mary packed the pants and **t-shirts/*highway** into the suitcase.

Emily went to the **hospital/*scarf** to visit her grandmother.

Anna diagnosed the **child/*barrel** with chicken pox at the hospital.

Kaitlyn traveled across the ocean in a **plane/*cactus** to attend the conference.

Megan likes to sprinkle **cashews/*telescopes** on her chocolate ice cream.

Peter took his **puppy/*cave** for a run around the block.

John preheated the **oven/*necklace** at four hundred degrees.

Thomas zipped up the **jacket/*doorknobs** because it was very cold outside.

Richard turned on the **television*/pistachio** to watch his favorite show.

Kevin peeled an apple and a **pear/*wagon** for the fruit salad.

Mary received a new mitt for Christmas and caught the **ball/*igloo** in it during baseball practice.

Mary loves peanut butter and **jelly/*bookcase** sandwiches.

Emily could not golf anymore since she hit the last **ball/*shoe** into the pond.

Anna went to the beach and now had to wash off the **sand/*phone** before starting work.

Kaitlyn was having eye trouble from looking at the screen of the **computer/*oven** all day yesterday.

Megan was babysitting and built a tower of **blocks/*jelly** that was taller than the couch.

Peter decided to make lemonade and mixed sugar and **water/*gravel** in the large pitcher.

John put the letter in the **mailbox/*water-hose** so it would arrive on time.

Thomas tried to pet the barking **dog/*jeans** after playing fetch.

Richard wrapped the present in **paper/*milk** and many colorful bows.

Kevin cannot eat many fruits like **apples/*trees** or pears due to an allergy.

Mary put bread in the oven because she enjoyed **toast/*piano** with jam for breakfast.

Emily played her **violin/*window** while everyone sang along.

Anna loves lying in the grass at night and looking up at the **stars/*pigs** in the clear sky.

Kaitlyn had to squint at the chalkboard after she stepped on her **glasses/*cake** and broke the lenses.

Megan was yelled at by her **parents/*glasses** for making fun of her sister.

Peter felt sick after eating an entire batch of **cookies/*laundry** that was meant for the bake sale.

John had nothing to wear because all the **clothes/*baseballs** were still in the washer.

Thomas felt very hot because he had a **fever/*carpet** caused by the flu.

Richard was having trouble in class and was sad to receive a bad **grade/*sock** on the test again.

Kevin was drinking a **soda/*poster** and spilled it all over the table.

Kevin spilled paint on the couch and flipped the cushion to hide the **stain/*umbrella** since it would not wash out.

Mary moisturizes with **lotions/*hairclips** because her skin is very dry.

Emily gossiped to her friend and started a **rumor/*street** about a girl in the class.

Anna did not like athletics and her least favorite class was **gym/*noodle** since it involved a lot of sports.

Kaitlyn could not see so she turned on the **lights/*shelter** to brighten the room.

Megan cut her leg on the nail and put a **bandaid/*television** on it to stop the bleeding.

Peter was riding his bike when he got a flat **tire/*bag** and walked the rest of the way.

John received a lot of money for his birthday and deposited it in the **bank/*sky** to save for a car.

Thomas went to the eye doctor who gave him a new pair of **glasses/*gloves** so he could see better.

Richard asked his mom to pass the salt and **pepper/*house** for his meal at dinner.

Kevin did not feel tired but fell asleep on the **couch/*ceiling** early in the evening.

Mary stopped wearing ponytails because the boys kept pulling her **hair/*marble** in between classes.

Emily added cereal to the bowl and then poured in **milk/*money** so she could eat breakfast.

Anna watched the couple become husband and **wife/*principal** during the wedding.

Kaitlyn watched the big storm and heard lots of **thunder/*teacher** throughout the night.

Megan wore penny loafers with knee-high **socks/*kidneys** as part of the school uniform.

Peter loves pasta so it is not surprising spaghetti with **meatballs/*newspaper** is his favorite meal.

John was eating pizza and poured a big glass of **soda/*ham** to drink with the snack.

Thomas did not like healthy food so he rarely bought fruits or **vegetables/*boxes** at the grocery store.

Richard washed the mud from his hands with hot water and **soap/*brick** in the kitchen sink.

Kevin made two hotdogs and put ketchup and **mustard/*mermaid** on both for dinner.

Mary always listened to loud **music/*orange** even though it gave her mom headaches.

Emily loved going to the pet store because it was filled with **animals/*sidewalks** to play around with.

Anna asked her teacher to line the boys up in the front and the **girls/*tubas** in the back today.

Kaitlyn wore rings on each of her **fingers/*hamburgers** to campus every day.

Megan used to love visiting the farm and helping milk the **cows/*pillows** a few days each month.

Peter microwaved the leftover **food/*crayon** at work for lunch.

John scraped the icing off the birthday **cake/*soccer** because he did not like chocolate.

Thomas visited the beach and swam in the **ocean/*closet** during the long weekend break.

Richard hates the cold so his favorite season is **summer/*broccoli** since the weather is warm.

Kevin took the clothes out of the washer and put them in the **dryer/*diary** so he could finish his laundry.

Mary watched the spider build a **web/*window** so it could catch flies.

Emily does not like needles so she tried to hide when the **doctor/*poodle** walked in the examination room.

Anna finished reading the book and returned it to the **library/*strawberry** to avoid paying a fee.

Kaitlyn swam in the **pool/*needle** to keep cool in the summer.

Megan turned on the radio so she could listen to **music/*bench** while she was in the car.

Peter wanted to play soccer but it had rained and the **field/*pencil** was still too muddy.

John liked to shop at different **stores/*candles** and visited the mall often.

Thomas wrote an **email/*eraser** to the president of the club.

Richard studies late in the **library/*juice** for his final exam.

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