Electrophysiological Correlates of Lexical Stress Perception in Bilinguals

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Introduction. In order to achieve native-like communication, second language (L2) speakers must accurately perceive and produce appropriate word stress patterns in their L2. These stress patterns provide important information about multiple aspects of grammar and meaning, and are processed pre-attentively by native (L1) speakers. Pre-attentive stress processing can be studied using the mismatch negativity (MMN), an early event-related potential (ERP) component that indexes auditory change detection [1]. For example, MMN responses are elicited when a listener detects a stress shift in a word or pseudoword in their native language [2, 3]. However, little is known about MMN responses during L2 stress processing. A recent study found that native English speakers showed stronger MMN responses than non-native speakers when presented with English pseudoword stimuli where stress occasionally shifted from a usual to an unexpected position [4]. We built on this to examine how English-French bilinguals processed lexical stress in pseudowords. Of note, different approaches are needed to process stress optimally in these bilinguals' two languages; English is a stress-timed language in which stress can occur at any number of syllable locations within an utterance, whereas French is a syllable-timed language in which stress always falls on the final syllable of an utterance.

Methods. In the present study, we recruited 34 sequential English-French bilinguals (18 English-L1, 16 French-L1) and estimated their relative language dominance using verbal fluency tasks. We then recorded MMNs in response to pairs of English and French pseudowords whose primary stress occurred either on a language-consistent "usual" (i.e., nocTICity/domiloGIE) or language-inconsistent "unusual" (i.e., NOCticity/domiLOgie) syllable. Each stimulus was used as both a standard and a deviant in an oddball paradigm, resulting in four conditions: English usual deviant, English unusual deviant, French usual deviant, and French unusual deviant. Based on previous studies, we expected that each deviant pseudoword would elicit two consecutive MMNs, regardless of whether it bore a usual or an unusual stress pattern, and that MMN amplitudes might be modulated by individual differences in participants' bilingual experience.

Results and discussion. Mean ERP amplitudes in two 50ms time windows in a fronto-central ROI were analysed using linear mixed effects models. The models evaluated the amplitude difference between standard and deviant stimuli for each condition (usual vs. unusual deviant) and each language separately. For the English trials (Figure 1), there were two MMNs in the unusual deviant condition but only one in the usual deviant condition, perhaps because the stress change is less salient when the deviant has a usual stress pattern [5]. Somewhat surprisingly, L1 and relative language dominance had no effect on these MMNs. For the French trials (Figure 2), there were two MMNs in both conditions. In the French unusual deviant condition, the MMNs were not affected by L1 or relative language dominance. In the French usual deviant condition, the second MMN was significantly larger than the first MMN, and its amplitude was marginally influenced by listeners' L1, suggesting that native listeners were better attuned to differences between word-final syllables than English L1 listeners. This follows logically given that native listeners likely have stronger representations of French prosody, in which stress is word final. There was no effect of relative language dominance on either MMN in this condition.

Conclusion. Overall, in most conditions we observed two MMNs as expected, but these MMNs were not modulated by bilingual experience. Our results therefore suggest that native-like stress processing is in fact possible for proficient bilinguals in both of their languages, and that

French-L1 speakers are capable of attaining native-like processing of L2 lexical stress (contrary to the previous suggestion that they are "stress deaf" [6]).

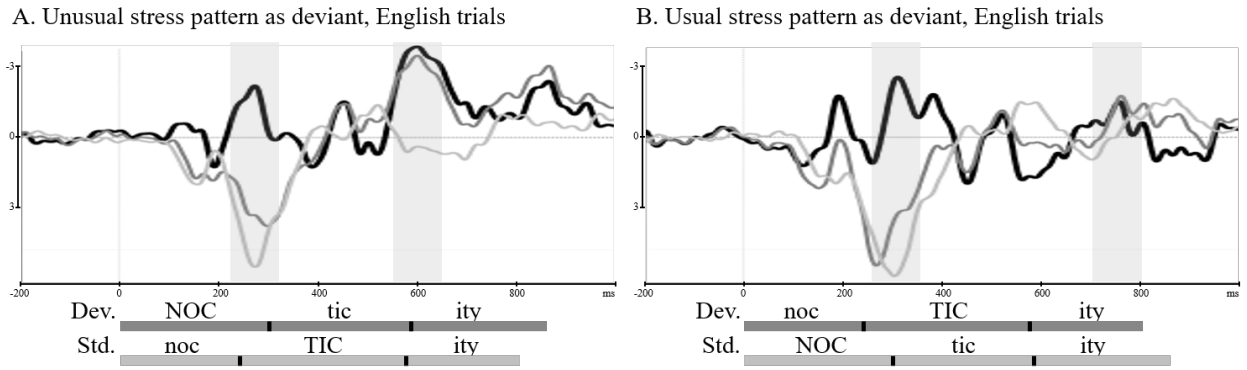

Fig. 1. Grand average ERPs to standard (light gray) and deviant (dark gray) English stimuli, with difference waveform (black), for native English listeners. Shaded areas represent 50ms time-windows around MMN peaks in difference wave.

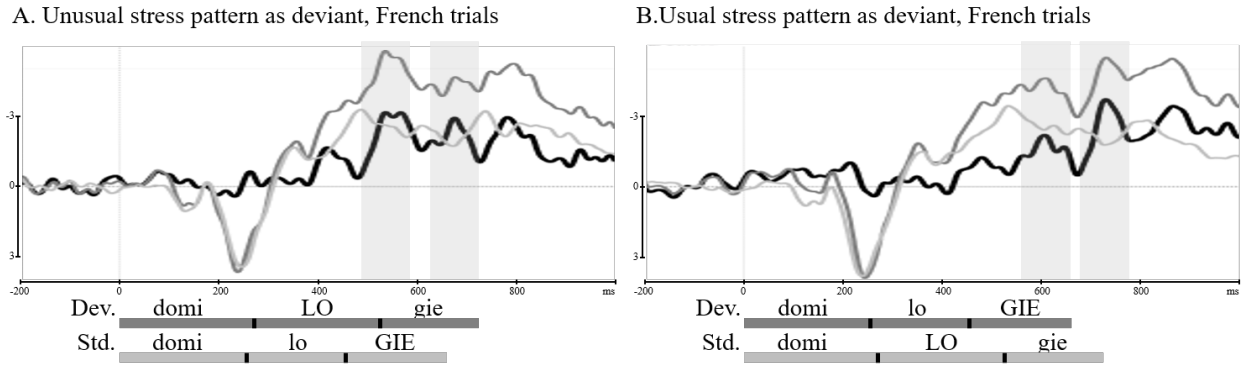

Fig. 2. Grand average ERPs to standard (light gray) and deviant (dark gray) French stimuli, with difference waveform (black), for native French listeners. Shaded areas represent 50ms time-windows around MMN peaks in difference wave.

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