Reduced Proficiency in a Second Language Leads to Delays in Early Lexical Processing

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The temporal delay assumption of the BIA+ model (Dijkstra & van Heuven, 2002) states that lexical access is delayed in bilinguals’ second language (L2) compared to their first (L1) because of lower proficiency. The reduced frequency hypothesis (Pyers et al., 2009) proposes that bilinguals’ use of multiple languages leads to reduced frequency of use and therefore weaker language ties in the L1 compared to monolinguals. However, as it is generally a language production hypothesis, it is unclear whether the reduced frequency hypothesis extends to word recognition studies, predicting slower lexical access in bilinguals’ L1 compared to monolinguals. Previous EEG studies investigating lexical processing speed have mainly either failed to test monolinguals against both languages of bilinguals (Proverbio et al., 2009), and/or have focused on later semantic components like the N400 (Ardal et al., 1990; van Heuven & Dijkstra, 2010).

We investigate these two hypotheses of lexical processing speed in the context of automatic reading by directly comparing monolinguals and bilinguals in L1 and L2 using concurrent EEG. We focus on an early orthographic recognition component, the N170, which is shown to be sensitive to language proficiency (Maurer et al., 2005). The Stroop task is used as a measure of automatic word processing, with long-latency stimulus onset asynchrony (SOA) variation (-400 ms, 0 ms, +400 ms) to gain additional automatic and temporal information on lexical processing in native and second languages. Experiment 1 tested monolingual English speakers on an English Stroop task with 128-channel EEG recording. Experiment 2 tested Chinese-English bilinguals on Chinese (L1) and English (L2) Stroop tasks in separate sessions. All bilinguals were native Chinese speakers with a late age of English acquisition (mean 11 years) and a self-rated English proficiency of 7/10.

An N170 was seen following word presentation in all SOAs for monolinguals and for bilinguals in both languages, demonstrating the automaticity of word reading even in a second language. At the N170 peak, monolinguals and bilinguals’ L1 showed differences in the symbol string control condition (‘%’) relative to word conditions. In the L2, words and symbol strings were distinguished later, on the downslope of the N170 peak. To directly compare the groups, difference waves (incongruent minus symbol string) were computed for each group and SOA. The difference waves showed peaks at 170 ms for monolinguals and bilinguals’ L1, reflecting lexical distinction at the N170 peak. These peaks did not significantly differ in latency, indicating no difference in lexical processing speed between bilinguals’ native language compared to monolinguals. The bilingual L2 lexical distinction peak, however, occurred significantly later (100 ms) compared to both the L1 and monolinguals (Figure 1) in all SOAs and despite repetition effects, suggesting a robust delay in lexical processing.

Thus monolinguals and bilinguals’ L1 showed no latency differences in lexical processing, suggesting that the reduced frequency hypothesis does not hold for bilingual word recognition. The L2, however, experienced significantly delayed early lexical processing, supporting the temporal delay assumption and confirming that a second language is
automatically activated but significantly delayed due to reduced proficiency and frequency of use.

References:


Figure 1: Difference waves (incongruent – symbol string) at electrode P7 (left tempo-parietal) for the -400 ms SOA (word appears 400 ms before colour), 0 ms SOA (colour and word simultaneous), and +400 ms SOA (word appears 400 ms after colour). Shaded regions indicate lexical processing peaks, representing the orthographic distinction between words and symbol strings, for monolinguals and bilinguals’ L1 (no difference; blue boxes), and bilinguals’ L2 (significantly delayed; pink boxes).