

Only proficiency predicts older bilinguals' word segmentation abilities in their second language

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Breaking down continuous speech into meaningful units is not a trivial task, yet we humans accomplish this feat effortlessly. A wealth of work has shown that adults and infants automatically integrate a number of cues available in the signal and has revealed important changes in their relative weight and interplay across development (e.g., Mattys et al., 2005). However, a single study to date has examined whether their use remains constant throughout adulthood (Palmer et al., 2018). Similarly, the handful of studies available investigating the segmentation abilities of bilingual populations have exclusively focused on infants and young adults. To fill this gap in our knowledge, we examine older adults' speech segmentation abilities, seeking to establish the impact of four central factors of bilingualism—age of acquisition, language proficiency, language use and frequency of language switch—in attaining native-like segmentation of their second language (L2). Specifically, we examine whether and how these different bilingual dimensions determine their use of semantic, syntactic and phonological information in word segmentation.

A hundred and fifteen healthy older adults (+65y) from the Basque Country (Spain) participated in this study. All participants were native or native-like speakers of Spanish, and their knowledge of Basque ranged from minimal to native or native-like. All four bilingual dimensions were assessed using self-report questionnaires. Proficiency was additionally assessed in a grammar test and two standardized tasks (i.e., a lexical decision task and a naming task, de Bruin et al., 2017). Frequency of language switch was also assessed in a free switch task. In addition, a series of control tasks accounted for potential effects of cognitive health (MiniMental State Examination-37), fluid intelligence (Raven's Progressive Matrices), and cognitive reserve (Cognitive Reserve Index Questionnaire). The segmentation task consisted of an adaptation to Basque of the one originally designed by Sanders and Neville (2000). Stimuli comprised 80 sentences, each presented in 3 versions (240 sentences in total): (1) "semantic" sentences were fully grammatical and meaningful, (2) "syntactic" sentences had all content words replaced with non-sense words while functors were preserved (as in Lewis Carroll's *Jabberwocky*), and (3) "phonological" sentences exclusively contained non-sense words, only preserving phonological information (i.e., prosody, phonotactics and coarticulation). Each sentence was assigned a target phoneme that occurred only once, and the participants' task consisted on indicating whether the target occurred word-initially or -medially.

Multiple regression analysis demonstrated that proficiency (defined as the 1st component of a PCA including all proficiency measures) was the only bilingual factor which significantly predicted accuracy in the segmentation task ($\chi^2(1)=67.08$, $p<0.001$). Moreover, they revealed significant interactions between proficiency and (1) sentence type ($\chi^2(2)=373.40$, $p<.001$) and (2) target position ($\chi^2(1)=3.87$, $p=.049$). Post hoc comparisons revealed greater gains in accuracy as proficiency increased in semantic sentences, as compared with syntactic and phonological sentences (both $p<.001$). In addition, they revealed larger proficiency related gains in accuracy in word-initial as compared with word-medial targets ($p<.001$).

These findings evidence a pivotal role of proficiency in word segmentation in older adult bilinguals and converge with previous literature showing different levels of plasticity across linguistic subsystems. The results also suggest that non-native speakers exhibit flexibility in using segmentation cues across the lifespan.

References

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Figure 1. Accuracy vs. Proficiency by Sentence type computed on estimated marginal means. Accuracy increased with proficiency in all cases, but semantic sentences produced the largest proficiency-related gains, as compared with the syntactic and phonological sentences.

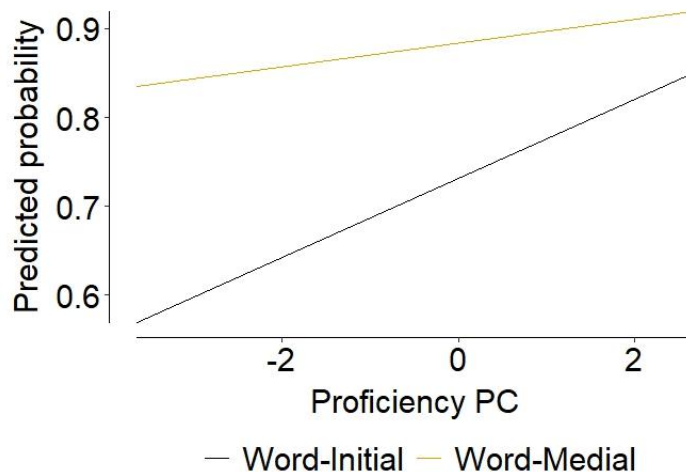
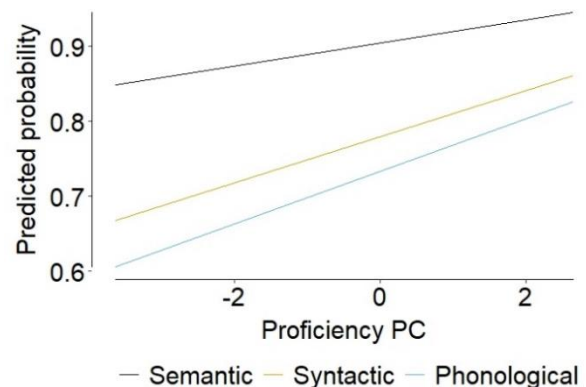


Figure 2. Accuracy vs. Proficiency by Target position computed on estimated marginal means. Accuracy increased with proficiency, and was generally greater in word-medial as opposed to word-initial targets. In addition, accuracy increases related to proficiency were larger in word-initial targets.