

Measuring Cross-Linguistic Influence in First- and Second-Generation Bilinguals: ERP vs. Acceptability Judgments

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Research on bilingual populations has long focused on cross-linguistic influence, but recent work has seen increased emphasis on investigating the effects of later-learned languages on the language learned in childhood (e.g., Montrul et al. (2008) for heritage speakers; Sorace (2011) for different types of bilingual populations). Much of this work uses behavioral tasks where the main findings point to systematic differences between speaker groups (e.g., monolingual vs. heritage speaker bilinguals in Montrul (2008); bilingual populations of varying ages and in varying states of immersion in the later-learned language in Sorace (2011)).

This study investigates the neural processes underlying such behavioral tasks and compares responses on an acceptability judgment task (AJT) to event-related potentials (ERP) in two types of bilingual populations. Specifically, for two Spanish-English bilingual groups varying in age of exposure to, and amount of use of English, we ask whether, and to what extent, processing patterns in the first-learned language, Spanish, are affected by the later-learned language, English.

Test sentences consisted of *wh*-questions with *Comp-trace* violations, where Spanish and English differ in the realization of these effects (e.g., Perlmutter, 1971; Zagana, 2001). As seen below, English exhibits deletion (1a) and Spanish shows retention (1b) of the complementizer (*that/que*):

- (1) a. Who do you think (*that) will come?
b. Quién crees *(que) vendrá?

We predicted that Spanish-English bilinguals who are under heavy influence of English should accept anomalous Spanish sentences without *que* (see also Montrul, Foot, & Perpiñán, 2008) and should also lack ERP components that indicate recognition of anomaly.

Results are reported for N=34 participants. Based on a language history questionnaire, participants were grouped as either a first-generation Spanish-English bilingual (FGB; N=19) or second-generation Spanish-English bilingual (SGB; N=15). FGBs were born and raised in a Spanish-speaking Latin American country and came to the U.S. after age 18 (M=25.56, SD=4.77). SGBs were born in the continental U.S. or were brought to the U.S. before the age of eight (M=1.52, SD=0.96) and were raised speaking primarily Spanish until at least age 10 by two FGB parents or a single FGB mother. To ensure adequate levels of Spanish proficiency for SGBs, who are often English dominant, we tested SGBs' comprehension with complex Spanish sentences. All SGBs scored at ceiling on the proficiency test, indicating fluency in Spanish.

Both FGBs and SGBs participated in the two experiments, with the ERP task preceding the AJT by at least ten days. Stimuli were the same in both experiments and were presented auditorily, as natural running speech. Context sentences (2a) and experimental stimuli (2b,c) are shown below:

- (2) a. Inés confesó que su hermana había comido la tarta.
b. Qué hermana confesó Inés ||que había comido la tarta?
What sister confess Inés that had eaten the cake?
c. *Qué hermana confesó Inés ||había comido la tarta?
What sister confess Inés had eaten the cake?
'What sister did Inés confess had eaten the cake?'

In the ERP experiment, participants listened to the sentences and were not asked to provide judgments. Continuous EEG data were recorded for 34 Ag/AgCl (sintered) electrodes, positioned according to the 10-20 International Electrode System, between DC–100Hz, with an A/D rate of 1000, and electrode impedances were kept below 15 kΩ. For the AJT, participants were asked to rate auditorily presented sentences using a five-point Likert scale (1="completely natural"; 5="completely unnatural") and were instructed to judge each sentence as quickly as possible.

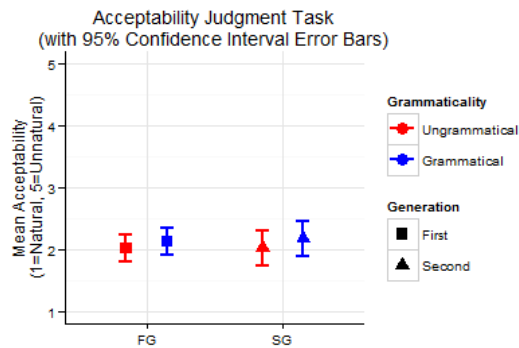


Figure 1: Mean naturalness ratings by generation and condition (95% confidence interval error bars)

ERP results: FGBs in Fig. 2 below show a negative-going wave at electrodes CZ, CP4 and CP3, at the onset of the verb complex (e.g., *había comido*; 0 ms in Figs. 2 and 3 is at “||” in the example stimuli 2b and 2c) for anomalous sentences without the complementizer *que*, when compared to sentences with *que*. This suggests an N400 effect, an index of a lexical anomaly. SGBs in Fig. 3 below, on the other hand, did not exhibit this pattern, indicating no recognition of a lexical violation.

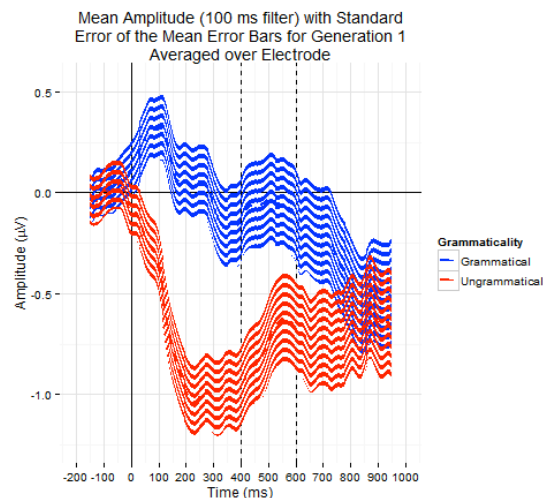


Figure 2: Mean amplitude by condition for FGBs (error bars show standard error of the mean, negative is plotted down)

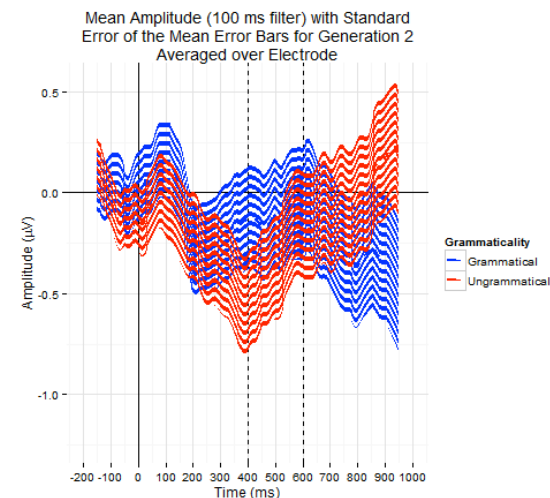


Figure 3: Mean amplitude by condition for SGBs (error bars show standard error of the mean, negative is plotted down)

Taken at face value, AJT results suggest that for both FGB and SGB, use of the complementizer *que* is optional, indicating English influence for both groups. In contrast to this between-group similarity, ERP results suggest diverging processing patterns for the two groups, with FGBs, but not SGBs, showing implicit and unconscious reaction to anomaly in *que*-less sentences. We interpret these results as an indication that explicit, behavioral tasks, such as acceptability judgments, lack sensitivity to processing mechanisms. We argue that acceptability judgments alone may not adequately capture the processes underlying language comprehension. Implications of these results for experimental approaches to bilingualism and heritage speakers in particular, will be discussed. Individual level analyses and correlations between ERP component amplitude and variance in use of English will also be presented.

References: Montrul, S., Foote, R., & Perpiñán, S. (2008). Knowledge of wh-movement in Spanish L2 learners and heritage speakers. In *Proceedings of the 10th Hispanics Linguistics Symposium*. (pp. 93–106). Somerville, MA: Cascadia Proceedings Project.; Perlmutter, D. (1971). *Deep and Surface Structure Constraints in Syntax*. New York: Holt, Rinehart & Winston.; Sorace, A. (2011). Pinning down the concept of “interface” in bilingualism. *Linguistic Approaches to Bilingualism*, 1(1), 1–33.; Zagana, K. (2001). *Syntax of Spanish*. New York: Cambridge University Press.

AJT results: FGBs rated sentences with *que* (see 2b) as natural ($M=2.02$, $SD=1.24$), and did the same for sentences without *que* (see 2c) ($M=2.14$, $SD=1.27$). SGBs showed similar results, giving sentences with *que* a mean rating of $M=2.17$ ($SD=1.41$), and sentences without *que* a mean rating of $M=2.02$, ($SD=1.44$). Linear mixed effects modeling showed that neither grammaticality ($\beta=0.14$, $SE(\beta)=0.20$, $t(16.40)=0.70$, $p=.50$; $\chi^2(1)=0.48$, $p=.49$) nor generation ($\beta=0.09$, $SE(\beta)=0.25$, $t(33.30)=0.36$, $p=.72$; $\chi^2(1)=0.13$, $p=.72$) significantly improved the fit of the model.