

Access to verb bias and plausibility information during syntactic processing in adult Spanish-
English bilinguals

Supplemental Materials

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Online supplement 1

Language history questionnaire. Participants were administered the LEAP-Q (Marian, Blumenfeld & Kaushanskaya, 2007)—a detailed language history questionnaire that assesses the language profiles of multi-lingual adult speakers. It asks about age of language acquisition, modes of language acquisition, prior language exposure, and current language use. The native speakers of English reported minimal to no knowledge of a second language. The Spanish-English speakers were born and raised in a Spanish speaking country; they were schooled in Spanish until adulthood, and then moved to the US to pursue further study. Responses to the questionnaire revealed that Spanish-English acquired functional proficiency in English during adulthood. At the time of data collection, participants lived in an English-speaking country; L2 speakers reported using both Spanish and English in their daily lives and in a variety of contexts.

Boston Naming Vocabulary Test (BNT). The Boston Naming test (Kaplan, Goodglass, & Weintraub, 1983) measures lexical access, vocabulary size, and naming performance. The test consists of 60 line drawings, graded in difficulty. Items are rank ordered in terms of their ability to be named, which is correlated with their frequency. Beginning at item # 38, participants encounter lower frequency words that are easily confusable with more common words, resulting in higher error rate (target: sphinx-typical response: pyramid; target: protractor-typical response: ruler; target: scroll-typical response: script or manuscript; target: pelican; typical response: seagull). The pictures have been normed and are useful in the evaluation of brain-injured adults and the examination of children with learning disabilities. The 60 images were divided into two language blocks (an English block and a Spanish block) of 30 images each; participants were asked to name the images as quickly and as accurately as possible. The drawings were presented in order of increasing difficulty, starting with easy, high-frequency words. The Spanish-English participants completed the BNT in their self-reported dominant language first. Participants received a score of 1 for correctly-named images and 0 for incorrectly-named or unnamed images. When naming in their native language, participants were equally accurate; when naming in English, the monolingual speakers named more images correctly than the non-native speakers did, but the non-native group was nevertheless able to name correctly a large number of pictures.

Grammatical judgment and semantic judgment tasks. Participants completed a speeded grammaticality judgment task and a speeded semantic judgment task. One-hundred fifty sentences (10 practice sentences, 35 syntactically anomalous trials; 35 semantically anomalous trials, and their respective correct counterparts) were distributed in four lists in a Latin Square design. Each list included 35 sentences containing grammatical violations (e.g., ‘Many doctors

claims that insurance rates are too high'), 35 sentences containing semantic violations (e.g., 'The pizza was shaved to the wrong apartment'), and 70 correctly constructed sentences (35 grammatically correct and 35 semantically congruent; e.g., 'Many doctors claim that insurance rates are too high' and 'The pizza was delivered to the wrong apartment', respectively). The sentences were displayed on a computer screen one word at a time using a rapid serial visual presentation procedure; we used this procedure to increase the level of difficulty of the judgment task, given that the presentation of the sentences was experimenter timed. The instructions required participants to read each sentence carefully and to judge whether they were acceptable by pressing "c" (yes) or "m" (no) on a keyboard. D prime scores revealed that both groups of participants were equally accurate judging the sentences.

Grammar tests. The L2 participants also completed the grammar sections of the Michigan English Language Institute College Entrance Test (MELICET) and of the Advanced Test of the Diplomas de Español como Lengua Extranjera (DELE). The MELICET is primarily used to test nonnative speakers of English by educational institutions as an admissions or placement test. The DELE is a standardized test of Spanish issued by the Ministry of Education, Culture, and Sport of Spain, which assesses proficiency in Spanish (<http://diplomas.cervantes.es/en>). Each grammar test contained 50 multiple-choice items that evaluated grammar, vocabulary, and reading competence in isolated sentences, as well as longer stretches of discourse. Participants received one point for each correct answer and zero for incorrect answers. Results showed that participants performed significantly better on the DELE than on the MELICET; again, however, performance on the MELICET indicated that the Spanish-English bilinguals had a good command of English.

Online supplement 2

Block analysis

To explore whether participants adapted to the experimental materials and changed their processing strategies over the course of the study, we grouped epochs into two halves (the first half and the second half of the experiment) prior to extracting the mean amplitudes. If adaptation occurred, we should expect differences between the first half and the second half of the experiment in the ERPs at the noun (N400) and the disambiguating auxiliary (P600). We conducted ANOVAs including the within-participant factors Block (First half vs Second half), Verb bias (DO vs SC), Plausibility (Plausible vs Implausible), Anterior/Posterior electrodes (Anterior vs Central vs Posterior) and Laterality (Left vs Midline vs Right) and the Group factor (Native vs Non-native).

At Time Window 1 (i.e., 300-500 ms after the post-verbal noun phrase—N400) none of the main effects were significant (all p s $>.1$). The Verb bias \times Anterior/Posterior region interaction was significant ($F[2, 82] = 5.51, MSe = 4.76, p = .01$), as was the interaction of Block \times Verb bias \times Plausibility \times Anterior/Posterior \times Laterality ($F = 3.33, p = .03$). Two separate ANOVAs per Block with Verb bias, Plausibility and the location variables were carried out to qualify the interactions. For the first half of the experiment, there was a marginal effect of Verb bias \times Plausibility \times Anterior/Posterior \times Laterality ($F[4, 168] = 2.59, MSe = 0.75, p = .07$). For the anterior, central and posterior regions, we did not find differences between the DO-plausible vs SC-plausible conditions, or between the DO-implausible vs SC-implausible conditions (all p s $>.1$). Likewise, contrasts between the DO-plausible and DO-implausible conditions, and SC-plausible and SC-implausible conditions did not show differences. For the second half of experiment, none of the effects was significant (all p s $>.1$).

At Time Window 3 (550-850 ms after the disambiguating auxiliary verb—P600), we found neither a main effect nor an interaction involving Block. The analysis evinced a Plausibility x Laterality interaction ($F[2, 82] = 4.58, MSe = 3.19, p = .02$) and a Verb bias x Plausibility x Anterior/Posterior factor interaction ($F = 6.41, MSe = 4.26, p = .009$). Planned comparisons were carried out to qualify the higher order interactions. We first examined the contrasts between DO-plausible vs SC-plausible, and DO-implausible vs SC-implausible sentences per region. DO- and SC-conditions differed when a plausible noun followed the main verb in posterior region ($F = 8.47, p < .001$) (central, $p = .08$; anterior region, $p > .1$). However, being followed by an implausible noun phrase did not cause differences in the ERP signal in any regions (all $Fs < 1$). Finally, we explored the effect of plausibility by comparing DO-plausible vs DO-implausible, and SC-plausible and SC-implausible conditions. No effect was significant for any contrast per region (all $ps > .1$). In all, evidence for adaptation remains inconclusive.