Sensitivity to Verb Bias as a Continuous Variable in L1 and L2 Processing

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Background: Verb structural continuation bias, or how often a verb occurs with different complement types, has been shown to influence syntactic processing in L1 [1] and in L2 [2,3], though its role in L2 processing is less well understood. While previous studies have shown that the bias of L2 verbs is used in L2 processing [2,3], the potential influence of L1 verb bias during L2 processing has not been demonstrated conclusively. The existence of such influence would align with prior findings about L1 interference regarding transitivity frequency in verbs [4] and would be expected under theories of bilingualism assuming parallel activation during processing [5]. Prior studies have largely treated verb bias as a categorical variable, with verbs categorized as direct object (DO) biased, sentential complement (SC) biased, or equi-biased. However, these categorizations could obscure fine-grained differences in bias strength that could influence processing in a continuous manner; furthermore, they limit the detail of comparisons of a verb's bias across languages, which is necessary to investigate the role of L1 verb bias in L2 processing.

Current Study: The current study aims to obtain continuous measurements of verb bias and use them in analyzing behavioral data collected by Wolford 2022 [3] to better understand the role of L1 and L2 verb bias in L2 processing. Wolford used a maze task to examine the L2 processing behavior of Spanish-English bilinguals (n = 60) in comparison with a group of English monolinguals (n = 60); stimuli were adapted from Dussias and Cramer Scaltz [2] and consisted of English sentences for each continuation type (Fig. 1).

Methods: Approximately 280 million words each of English and Spanish plaintext corpora were programmatically parsed, collected from the Corpus of Contemporary English (COCA) and the Corpus del Español respectively. The corpora were tokenized by sentence, and dependency representations of sentence structure were created using UDPipe, a multilingual dependency parser [6]. These dependency parses were used to categorize the type of complement each verb occurred with, and counts for each continuation type were recorded for all verbs used in the experimental stimuli by Wolford [3]; these counts were then used to calculate continuous verb bias probabilities and corresponding syntactic surprisal values.

Results: The calculated continuous verb bias values agreed reasonably well with prior verb bias categorizations for the English verbs by Garnsey et al. [7] and for the Spanish verbs by Dussias et al. [8] (Fig. 2). When used to analyze Wolford's [3] maze task data, the results showed that the continuous English verb bias measurements were a significant predictor of RTs for the monolingual control group ($\beta = 0.13$, SE = 0.02, $p < 0.001$; Fig. 3). The analysis of the bilingual participants' RTs indicated that the verb bias values of the equivalent Spanish verbs were a better predictor of RTs ($\beta = 0.03$, SE = 0.01, $p < 0.05$) than the verb bias of the English verbs encountered in the stimuli which were not shown to be a significant predictor (Fig. 4); the analysis also found that the range of DO syntactic surprisal values for the Spanish verbs was significantly smaller than for the SC values (Fig 4.)

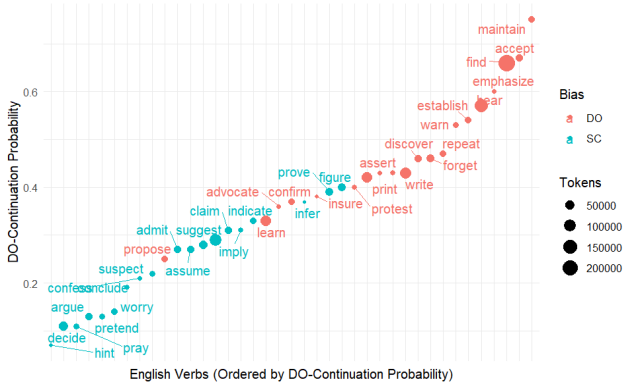
Conclusion: These results suggest that verb bias influences processing in a gradient manner. Moreover, they indicate that L1 verb bias may influence L2 sentence processing, potentially to a greater extent than L2 verb bias. Future research should seek to replicate these findings with other language pairs and levels of L2 proficiency.

References: [1] Clifton et al., 1984. *Journal of Verbal Learning and Verbal Behavior*. [2] Dussias & Cramer Scaltz, 2008. *Acta Psychologica*. [3] Wolford, 2022. *HSP*. [4] Frenck-Mestre & Pynte, 1997. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology*. [5] Kroll & Ma, 2017. [6] Straka & Straková, 2017. *Association for Computational Linguistics*. [7] Garnsey et al., 1997. *Journal of Memory and Language*. [8] Dussias et al., 2010. *Behavior Research Methods*.

Figure 1.

Unambiguous	The ticket agent admitted that the mistake might not have been caught.
DO Continuation (Ambiguous)	The ticket agent admitted the mistake because she had been caught.
SC Continuation (Ambiguous)	The ticket agent admitted the mistake might not have been caught.

Figure 2.



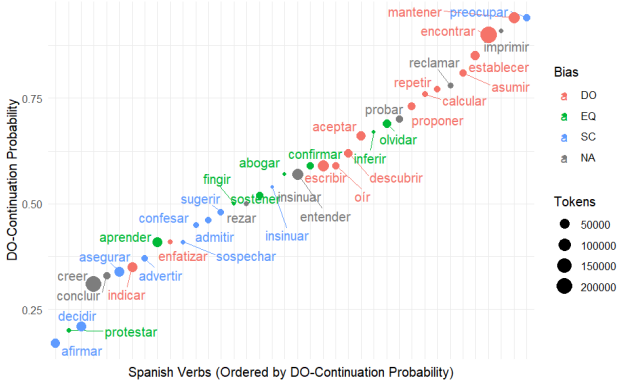


Figure 3.

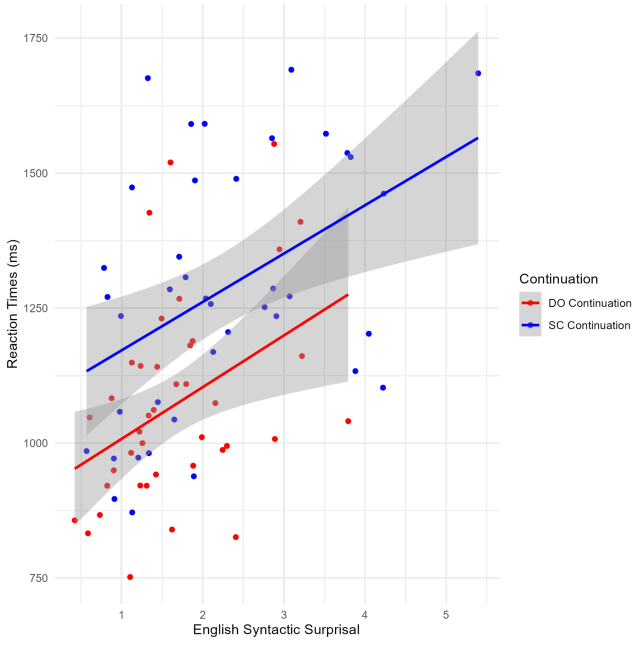


Figure 4.