

## The use of pronoun interpretation biases in unbalanced Spanish-English bilinguals: the role of language experience

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Recent research on pronoun interpretation has shown that the strength of pronoun interpretation biases in English correlates with comprehenders' print exposure, demonstrating that language experience influences anaphora resolution in adults (e.g., Arnold, Strangmann, Hwang, Zerkle, & Nappa, 2018) and that individual variability among comprehenders may exist (e.g., Arnold, 2015). A question that remains open is how language experience affects anaphora resolution biases in languages other than English. In the present study, we focus on Spanish, a null-subject language where null pronouns typically refer to topic antecedents and overt pronouns refer to non-subject antecedents:

- (1) Pedro<sub>i</sub> saludó a Carlos<sub>j</sub> cuando él<sub>i/pro<sub>i</sub></sub> cruzaba la calle  
Pedro greeted Carlos when he crossed the street

We look at a population of speakers that presents variability and optionality in pronoun interpretation biases, i.e., unbalanced bilinguals whose first language (L1, Mexican Spanish) is a minority language. Importantly, these speakers learn the minority language in the family and do not receive formal school education in the L1. In addition, their dominant language (L2, English) is a non-null subject language, which may interfere in the acquisition of L1 interpretation biases. We recruited seventy-four Spanish-English unbalanced bilinguals with different levels of proficiency in Spanish and we analyze individual factors that may determine variability in pronoun interpretation (i.e., language proficiency measured with a naming task, reading exposure measured with self-reported measures). Sixty-three monolinguals who speak the same regional variety of Mexican Spanish were recruited for the control group.

We used a sentence comprehension task where participants had to choose the referent of an ambiguous null/explicit pronoun in anaphoric or cataphoric position (Table 1). The comprehension question included a subject referent interpretation for the pronoun, an object referent interpretation and the external referent interpretation (i.e., someone else).

First, we compared the subject antecedent interpretations in bilingual and monolingual speakers, using mixed-effects logistic regression. The results showed that bilinguals chose the subject antecedent significantly more often than monolingual speakers for anaphoric and cataphoric pronouns ( $p < .0001$ ), and for null and explicit pronouns ( $p < .0001$ ). The strong subject preference for all pronoun types is a new result found in Spanish-English bilinguals, indicating high variability in pronoun preferences in this population, and cross-linguistic interference from English.

We analyzed the bilingual data separately, to investigate the effects of individual variables on pronoun interpretation in the L1, using mixed-effects logistic regression. The analysis of the bilingual data revealed a Reading Exposure\*Pronoun Position interaction indicating that bilinguals who read more in Spanish chose fewer subject-antecedent interpretations for cataphoric pronouns ( $p < .0001$ ), approaching the monolingual pattern of interpretation. A Reading Exposure\*Anaphora Type interaction demonstrates that bilinguals who read more in Spanish chose fewer subject-antecedent interpretations for explicit pronouns ( $p < .0001$ ). No significant effect of reading exposure emerged for null and anaphoric pronoun. (Figure 1).

A main effect of Proficiency ( $p < .04$ ) also indicated that bilinguals with higher Spanish proficiency chose overall fewer subject-antecedent interpretations than bilinguals with lower proficiency.

The results demonstrate an interplay between print exposure and proficiency on the acquisition of pronoun interpretation biases in L1 Spanish. Bilinguals who read more and have higher proficiency in Spanish show more monolingual-like pronoun interpretations, demonstrating that pronoun comprehension preferences are acquired by language experience (e.g., Arnold et al., 2018). The effect of reading exposure for pronouns that are more infrequent in the input (explicit pronouns, cataphora) demonstrates that reading exposure can provide discourse input that adds to the development of pronoun interpretation biases in bilinguals lacking L1 literacy.

**Table 1. Average subject (=Pedro), object (=Carlos) and external (=someone else) referent pronoun interpretation in unbalanced bilinguals and monolinguals.**

	Unbalanced Bilinguals			Spanish monolinguals		
	Subject	Object	External	Subject	Object	External
Anaphora Null Pronoun Pedro greeted Carlos when (he) crossed the street	0.73	0.26	0.01	0.62	0.37	0.02
Anaphora Explicit Pronoun Pedro greeted Carlos when he crossed the street	0.57	0.41	0.02	0.37	0.60	0.04
Cataphora Null Pronoun When (he) crossed the street, Pedro greeted Carlos	0.88	0.05	0.06	0.65	0.06	0.29
Cataphora Explicit Pronoun When he crossed the street, Pedro greeted Carlos	0.86	0.07	0.07	0.47	0.12	0.42

**Figure 1. Average subject-antecedent interpretations for anaphoric/cataphoric pronouns (top panel) and null/explicit pronouns (bottom panel) based on average Spanish reading exposure percentage in unbalanced bilingual speakers.**

