Heritage Speakers of Spanish pattern with Spanish-dominant speakers in facilitative processing of gender & number agreement

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Background Studies on real-time language processing in heritage languages consistently show that heritage speakers (HSs) demonstrate facilitative processing of grammatical gender, despite reduced input to the learner and non-target like production and comprehension of gender agreement **[ex. 1,2]**. However, existing work has observed only facilitative processing of gender in isolation: in existing studies, the pre-nominal agreement marker that carries the gender feature occurs in the singular (and, in case-marking languages, in the nominative **[3]**). Still, in many languages, gender agreement marking co-occurs with other grammatical agreement, and it remains an open question whether HSs' facilitative processing remains target-like when grammatical gender co-occurs with other agreement features.

Aims The present study aims to determine whether HSs of Spanish show facilitative processing of gender when it co-occurs with number. In Spanish, these two features are encountered simultaneously during incremental processing of the masculine plural definite determiner *los* (cf. M.SG *el*, F.SG *la*, F.PL *las*), as the vowel /o/ serves as the point of disambiguation to the article being both masculine and plural.

Methods Spanish-dominant speakers (n=23; average age of arrival to US: 23.7 years old) and HSs of Spanish (n=53; average age of arrival to the US: 2.2 years old) completed an eye-tracking task in the Visual World Paradigm, as well as lexical proficiency tasks and a language background questionnaire. In the eye-tracking task, 200 displays were paired with auditory stimuli of the form *Indica {el/la/los/las} [noun]* ('Indicate the [noun].'). Each display contained three images: the target, the distractor (opposite number and gender as the target), and a competitor whose gender and number features were manipulated as in **Table 1**. The experiment was fully counter-balanced; given our aims, here we discuss M.PL targets only.

Predictions Based on prior work, we expect both groups to show more looks to the target in mismatch than match conditions. If facilitative processing of gender is reduced when it co-occurs with number, looks to the target should be reduced in the partial-match-number condition relative to the mismatch condition. If facilitative processing of number is reduced when it co-occurs with gender, looks to the target should be reduced in the partial-match-gender condition.

Results Cluster-based permutation analyses **[4]** were used to identify clusters of time bins in which looks to the target differed by condition from 200ms after the onset of the article. Results for trials with masculine plural targets are presented in **Figure 1**. Separate analyses were run for each group and for each partial-match condition; each time condition was treatment-coded as a three-level categorical variable to compare each partial-match condition (reference level) to the match and mismatch conditions. Significant clusters for the contrast between mismatch and partial-match-num conditions were found for both controls and HSs **[Table 2]**, indicating looks to the M.PL target were reduced in the presence of a F.PL distractor. No significant clusters were found for the contrast between mismatch and partial-match-gen conditions for either group, indicating that looks to the M.PL target were not reduced in the presence of a M.SG competitor.

Implications The findings suggest that HSs pattern with Spanish-dominant control speakers in facilitative processing of gender (and number), even when the features occur simultaneously, providing new evidence of HSs' target-like processing of grammatical gender even in the context of increased featural complexity. Looks to the target were reduced for both groups in the presence of a competitor that is compatible with just the plural feature, but not in the presence of a competitor compatible with just the gender feature. This is consistent with findings that speakers attend more to semantic than grammatical cues **[5]**.

Table 1 critical conditions for M.PL targets

	Target		Competitor		Distractor	
mismatch	M	PL	F	SG	F	SG
partial-match-num	M	PL	F	PL	F	SG
partial-match-gen	M	PL	M	SG	F	SG
match	M	PL	M	PL	F	SG

Table 2 significant clusters for contrasts in cluster-based permutation analysis

Condition	Group	Contrast	Cluster time	Cluster mass statistic	p
partial-match-num	Control	mismatch	1925-2325ms	23.7	<0.001
		match	2225-2325ms	30.5	<0.001
	Heritage	mismatch	2025-2375ms	60.9	<0.001
		match	1775-2475ms	112.0	<0.001
partial-match-gen	Control	match	2000-2450ms	274.0	<0.001
	Heritage	match	1650-2450ms	503.0	<0.001

Figure 1a partial-match-number condition; sig. clusters for contrast with mismatch condition marked in gray
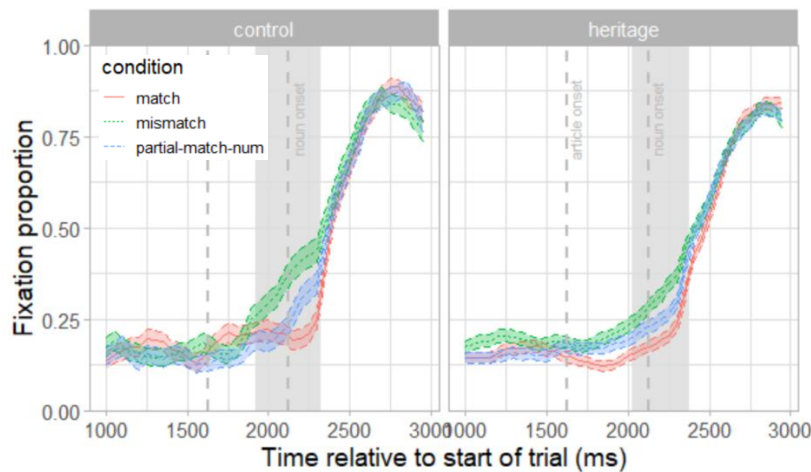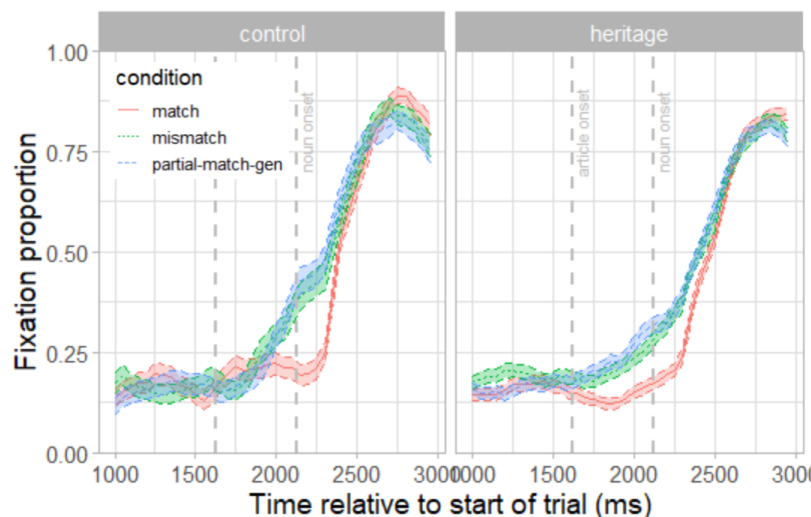

Figure 1b partial-match-gender condition; no sig. clusters for contrast with mismatch condition

References [1] Fuchs, Z. (2021). Facilitative use of grammatical gender in Heritage Spanish. *Linguistic Approaches to Bilingualism*. **[2]** Keating, G. D. (2022). The effect of age of onset of bilingualism on gender agreement processing in Spanish as a heritage language. *Language Learning*, 72(4), 1170-1208. **[3]** Aumeistere, A., Bultena, S., & Brouwer, S. (2022). Wisdom comes with age? The role of grammatical gender in predictive processing in Russian children and adults. *Applied Psycholinguistics*, *43*(4), 867–887. **[4]** Maris, E., & Oostenveld, R. (2007). Nonparametric statistical testing of EEG- and MEG-data. *Journal of Neuroscience Methods*, *164*(1), 177–190. **[5]** Ito, A., Nguyen, H. T. T., & Knoeferle, P. (2023). German-dominant Vietnamese heritage speakers use semantic constraints of German for anticipation during comprehension in Vietnamese. *Bilingualism: Language & Cognition*.