

EYE-TRACKING INVESTIGATION OF RELATIVE CLAUSE PROCESSING IN TWO GROUPS OF BILINGUAL SPEAKERS

Christen N Madsen II, Michael Stern, LeeAnn Stevens, Cass Lowry, Gita Martohardjono
The Graduate Center, City University of New York

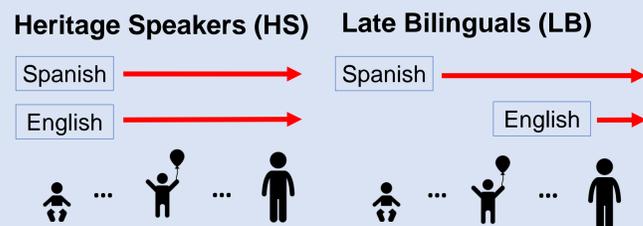
Introduction

- First-language processing is “permeable” to the effects of later-learned languages.
- Dominance, or relative language proficiency, modulates the effects of later-learned languages on the first-learned language.
- **This study examines bilingual processing of relative clauses, a structure with a widely documented processing asymmetry favoring subject relative clauses.**
- **We use eye-tracking in the visual world paradigm to measure processing of auditorily presented subject and object relative clauses in the first-learned language (Spanish).**
- **We compare heritage speakers of Spanish (English-dominant) to Spanish-English late bilinguals (Spanish-dominant).**

Research Questions

1. Do fluent bilingual adults demonstrate the subject/object processing asymmetry in their first-learned language in the visual world paradigm?
2. Do heritage speakers differ from late bilinguals in their processing of relative clauses in the first-learned language?

Participants



Bilingual Group	Age	Age Of Arrival	Length of US Residency	Dominance Score (English)
HS (n=19)	25.5 (7.1)	2.4 (3.0)	22.5 (6.0)	42.0 (35.0)
LB (n=20)	30.1 (9.2)	25.2 (7.2)	5.0 (5.1)	-66.8 (40.8)

Stimuli & Procedure

1. Subject relative clauses (n = 10)
 El gato, que jala al conejo, corta al oso.
The cat, who pulls the rabbit, cuts the bear.
2. Object relative clauses (n = 10)
 El conejo, que el gato jala, corta al oso.
The rabbit, who the cat pulls, cuts the bear.

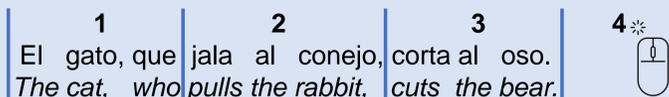
One target image and two distractor images:



- Stimuli are presented auditorily as natural speech.
- Participants are asked to click the correct picture.
- Gaze fixations are recorded with a Tobii TX300 eye-tracker recording at 60 Hz.

Analysis

Fixation data is binned to four temporal regions:

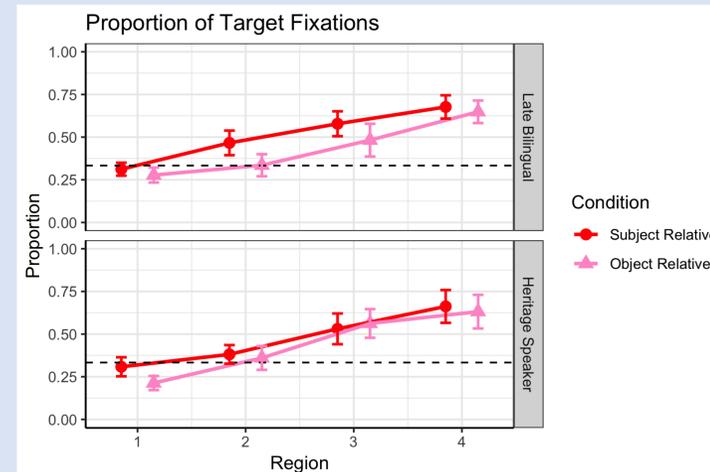


- Mean fixation proportions on the target image are calculated **by group, by condition, by region.**
- Fixation data is fit with **beta regression models** to analyze effects of **group and condition** on target fixation proportions in each region.
 1. μ = Mean of {0%-100%}
 2. σ = Dispersion of {0%-100%}
 3. v = Likelihood of 0% fixation
 4. τ = Likelihood of 100% fixation

- Comprehension accuracy and log-transformed reaction time are modeled with **logistic and linear mixed effects models** to analyze effects of **group and condition** on behavioral responses.

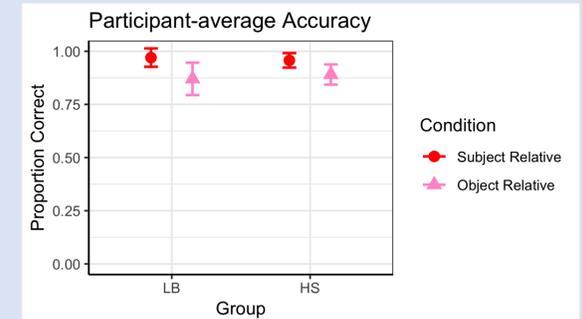
Results

Gaze Data

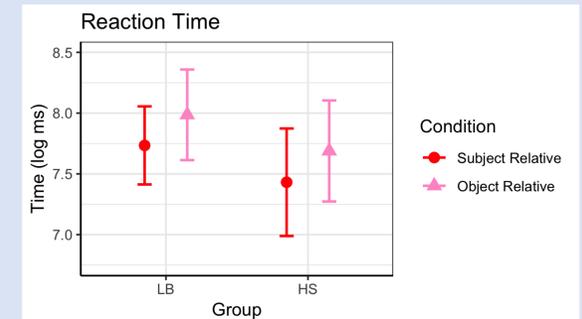


- Late bilinguals are significantly less likely to fixate on the target image during object relative clauses than subject relative clauses in Region 2 ($p_v < .001$) and Region 3 ($p_v < .001$).
- During subject relative clauses, heritage speakers are significantly less likely than late bilinguals to fixate on the target image in Region 2 ($p_v < .01$, $p_\tau < .05$).
- By Region 3, heritage speakers “catch up” to late bilinguals, i.e., the by-group difference is no longer significant ($p_v = .62$, $p_\tau = .13$).

Behavioral Data



- Across groups, participants are significantly less accurate on object relative clauses than subject relative clauses ($p < .01$).
- Group is not a significant predictor of accuracy.



- Across groups, the difference in reaction times between object and subject relative clauses approaches significance ($p = .09$).
- Group is not a significant predictor of reaction time.

Conclusions

- Both groups increase fixations to the target image prior to completion of the sentence, suggesting **first-language predictive processing across groups.**
- Only late bilinguals demonstrate the subject relative clause processing advantage, suggesting that **greater dominance in the first-learned language causes more active prediction in first-language processing.**
- There are no group differences in comprehension accuracy or reaction time, suggesting that **online processing is more sensitive to the effects of language dominance than offline comprehension.**

Next Steps

- Analyze the effects of dominance along a continuum within and across the two participant groups.
- Analyze fixations during each word within each temporal region to determine what particular events are facilitating prediction in processing.
- Run the same experiment with English stimuli.

Acknowledgments

Thank you to our participants, as well as research assistants Daniela Castillo, Omar Ortiz, Christina Dadurian, Andrea Monge, Matthew Stuck, and Armando Tapia.

93rd Annual Meeting of the Linguistic Society of America.

Contact: CUNY Graduate Center SLA Lab, slal@gc.cuny.edu

Corresponding author

Michael Stern

mstern@gradcenter.cuny.edu

862-242-6744

Second Language Acquisition Lab

The Graduate Center, CUNY

365 5th Ave, Room 7393

New York, NY 10016

212-817-8524

slal@gc.cuny.edu