The Effect of Immersion Language Learning on Eye-movement Characteristics in Sentence Reading among Second-Language Learners

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Introduction

- Immersive language programs (IM) can lead to linguistic production and comprehension gains comparable to those achieved through study-abroad programs (Freed et al., 2004; Moranski et al., 2023; Moranski, 2025).
- Research on L2 reading fluency in immersive contexts remains limited and yields mixed findings (Dewey, 2004; Jacobs et al., 2016; Rifkin, 2005).

Present study's key questions:

1) Does at least two weeks of Spanish or Russian immersion lead to changes in L2 reading fluency, as reflected in early (e.g., gaze duration, word skipping) and late (e.g., total reading time, regressions) eye-movement measures?
2) How do eye-movement characteristics in L2 reading differ between Spanish and Russian languages, and are these differences shaped by immersion?
3) To what extent is the effect of immersion on eye-movements moderated by L2 proficiency?

Methods

Participants

- 27 adult English-dominant bilinguals (Spanish: n = 13; Russian: n = 14) enrolled in Middlebury College's summer immersion programs. All were native English speakers learning Spanish or Russian as an L2.
- Inclusion Criteria: participants at Level 1.5+ in *Spanish* or Level 2+ in *Russian*

Materials & Procedure

- Eye-movements were recorded using an EyeLink 1000 eye-tracking system.
- Participants completed 2 in-person sessions, with at least 14 days between sessions.

Table 1 – *Experimental Design for Spanish and Russian: 80 Corpus Sentences per Language*

	SESSION 1	SESSION 2
Sentence Set	40 randomly selected sentences + 3 practice trials	40 remaining sentences + 3 practice trials
Comprehension Task	1 multiple-choice question per sentence	
Lexical Properties	Words are annotated for lexical frequency, length, and predictability.	

Results

- Participants, regardless of language, showed significantly shorter gaze duration (Est. = 0.03, SE = 0.01, $p < 0.001$) and shorter total reading times (Est. = 0.08, SE = 0.01, $p < 0.001$) in Session 2 compared to Session 1.
- Russian words elicited significantly longer gaze durations (Est. = 0.22, SE = 0.04, $p < 0.001$) and total reading times (Est = 0.24, SE = 0.06, p = 0.001) than Spanish words.
- Higher L2 proficiency was associated with shorter total reading times (Est. = -0.22, SE = 0.06, $p < 0.001$) and reduced *word regressions* (i.e., the tendency to re-read a word or phrase), which suggested better reading fluency.

Figure 1 – *Mean Fixation Durations by Session and Language (Spanish vs. Russian).*

Note. *GD* = gaze duration; *TT* = total reading time.

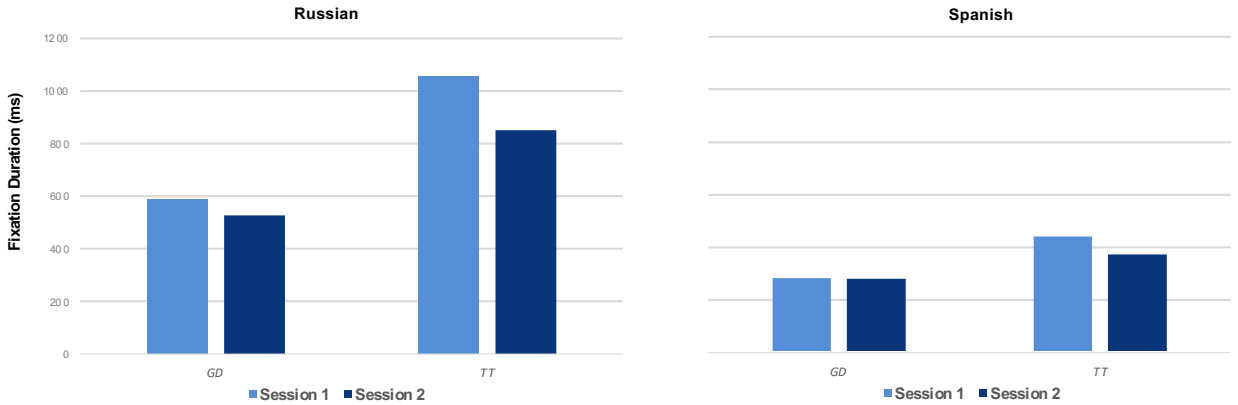
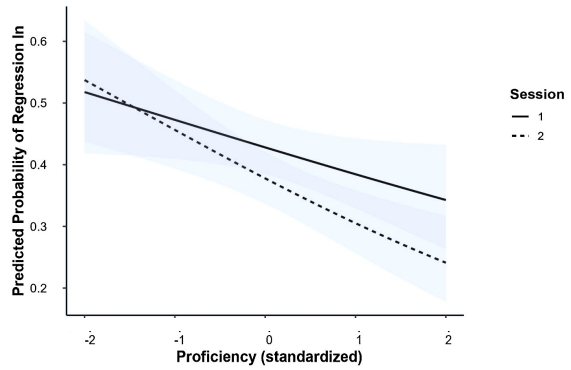


Figure 2 – *Predicted probability of regressions into words as a function of standardized proficiency level and session. Shaded areas represent 95% confidence intervals.*



Discussion

- Across both language groups, immersion language experience was associated with shorter word fixation duration, shorter total reading time, fewer regressions.
- Reduced reading time and regressions in Session 2 suggest a decrease in cognitive effort during semantic processing and syntactic reanalysis.
- Spanish readers outperformed Russian readers, likely due to shorter sentences, higher word predictability, and greater orthographic, phonological, and morphosyntactic similarity between Spanish and English.

Limitations & Future Directions

- Due to the lack of a control group (i.e., Spanish and Russian monolinguals), reading improvement may be influenced by increased familiarity of task over time, which thus caused a low internal validity.
- These findings were based on a small sample (N = 27) from Summer 2024 and may not generalize to a larger L2 population. We are continuing data collection this summer for non-native Spanish and Russian speakers, and hope to expand the work to include a control group in Fall 2025.

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References