Research methods for the study of real-time sentence processing by heritage speakers

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Introduction

- In experimental research on heritage speakers, a consideration is that they tend to have underdeveloped literacy, metalinguistic skills, and formal register (Carreira & Kagan, 2011) and that this may affect the results of some types of tests
- Some scholars have advocated for a shift away from traditional metalinguistic judgment measures in heritage language research (Benmamoun, Montrul, & Polinsky, 2010) and also towards real-time psycholinguistic methods like self-paced reading, eyetracking, and ERPs (Bolger & Zapata, 2011; Jegerski, 2018)
- The broader goal of this study was to explore the potential of two research methods: self-paced reading, eyetracking

The Present Research Study

- Two experiments on sentence processing among heritage speakers of Spanish: self-paced reading, eyetracking
- Examined the intersection of verb argument specifications (transitive vs. intransitive) and the processing principle of Late Closure (incorporate new elements into the existing phrase; Frazier & Fodor, 1978)
- Comparison of heritage language sentence processing behavior with that of native speakers who acquired Spanish in a majority language context (who have fully developed literacy, perhaps stronger metalinguistic knowledge, etc.)
- Research methods: comparison between self-paced reading and eyetracking, specifically in research on heritage speakers

Experiment 1:

SELF-PACED READING

~~Mientras el maestro descansaba el violín resonaba por todo el salón.~~

¿Dónde puede estar este músico?

a. En un parque.

b. En un teatro.

Participants

	Heritage Speakers (n = 32)			NS/Late Bilinguals (n = 16)		
	M	SD	range	M	SD	range
Age	20.3	2.9	17 – 29	25.8	5.6	18 – 38
Age of arrival	.3	1.1	0 – 5	19.1	6.9	10 – 34
Age of onset of bilingualism	4.2	2.0	0 – 8	14.0	1.7	10 – 16
DELE score	41.0	2.8	37 – 47	45.6	3.3	38 – 49
Self-ratings - English						
Speaking	9.3	.9	6 – 10	7.8	1.1	5 – 10
Understanding	9.3	.9	7 – 10	8.3	1.0	7 – 10
Reading	9.3	.8	7 – 10	8.2	.7	7 – 9
Self-ratings - Spanish						
Speaking	8.5	1.2	5 – 10	9.4	.6	8 – 10
Understanding	9.0	.88	7 – 10	9.6	.5	9 – 10
Reading	8.0	1.4	5 – 10	9.4	.6	8 – 10

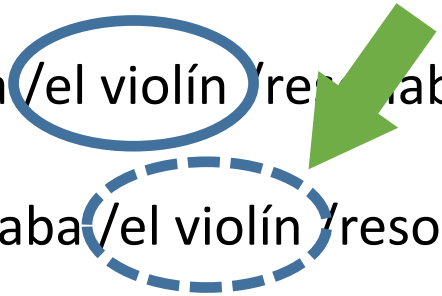
Materials: SPR Stimuli

(a) *Transitive verb*

Mientras el maestro /tocaba /el violín /resonaba /por todo el salón.

(b) *Intransitive verb*

Mientras el maestro /descansaba /el violín /resonaba /por todo el salón.

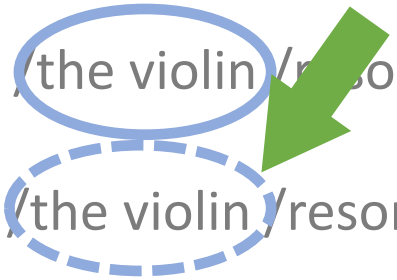


Transitive verb

"While the maestro /played /the violin /resonated /throughout the hall."

Intransitive verb

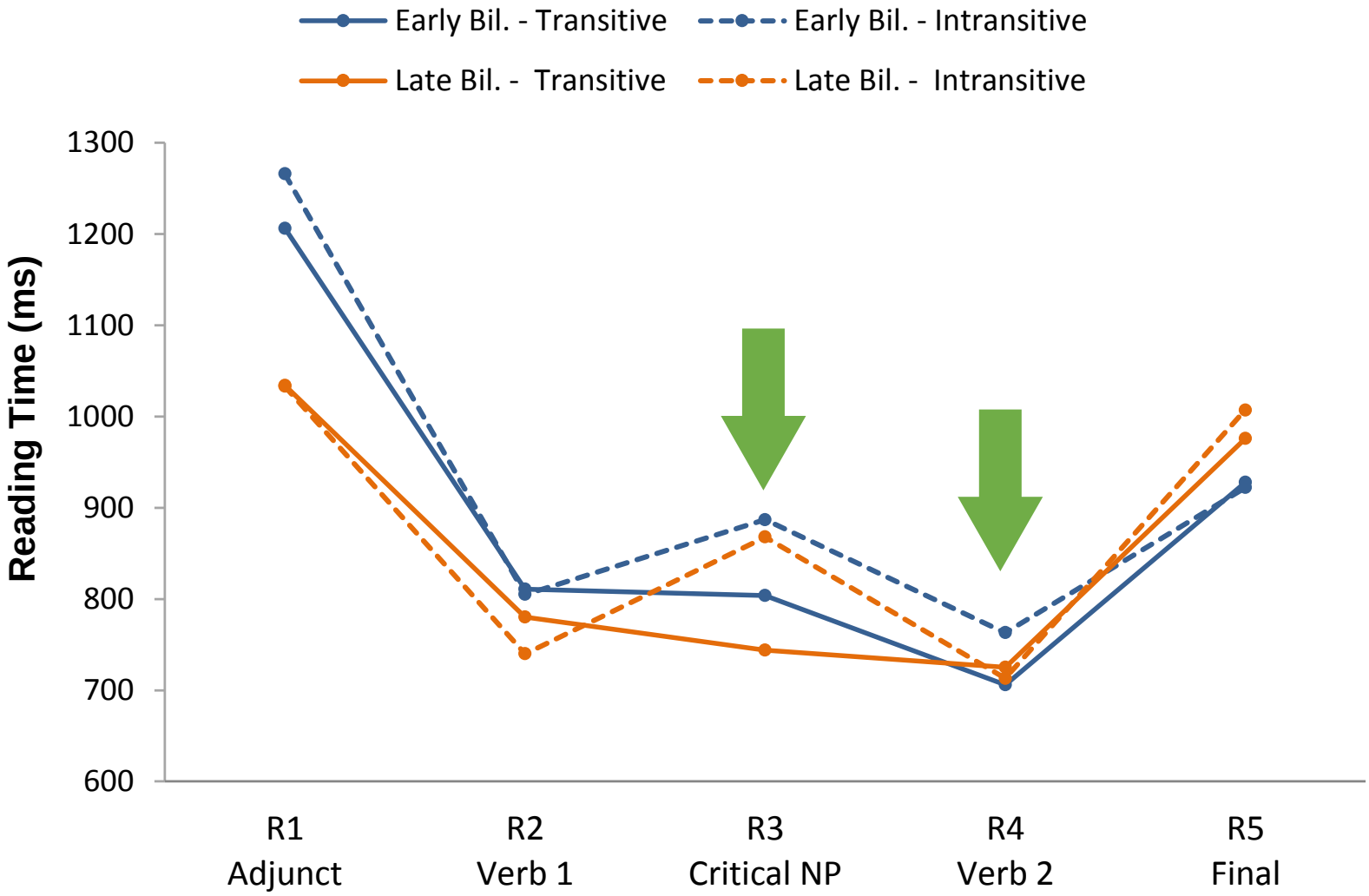
"While the maestro /rested /the violin /resonated /throughout the hall."



Procedure

- Self-paced reading, left-to-right, non-cumulative display (moving window)
  - Records reading times in milliseconds for each part of a stimulus sentence
- 20 experimental sentences, 10 in each condition
- + 140 distractors, also 10 practice items
- Each stimulus was followed by a comprehension question to ensure that participants read for meaning

Results: SPR


Early Bil. - Transitive
Early Bil. - Intransitive
Late Bil. - Transitive
Late Bil. - Intransitive
Reading Time (ms)
1300
1200
1100
1000
900
800
700
600
R1
Adjunct
R2
Verb 1
R3
Critical NP
R4
Verb 2
R5
Final

Discussion: Experiment 1

- Both groups showed the expected effect at the post-verbal NP – Late Closure during processing
- The effect carried over onto the following region, only among the heritage speakers
- This difference could indicate greater difficulty with repair and reanalysis of sentence structure
- Or the difference might be related to the task and to reading more generally
- Eyetracking might help to determine which explanation is more likely

Experiment 2:

EYETRACKING

Eyetracking

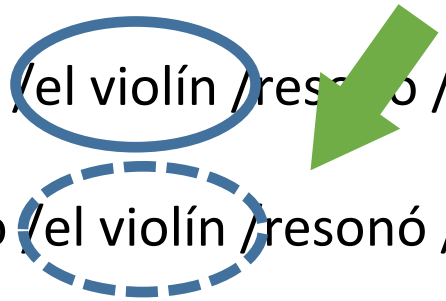
Participants

	Heritage Speakers (n = 58)			NS/Late Bilinguals (n = 41)		
	M	SD	range	M	SD	range
Age	20.2	2.4	18 – 29	21.9	3.0	18 – 31
Age of arrival	.4	1.1	0 – 5	21.2	3.2	17 – 31
Age of onset of bilingualism	3.4	1.8	0 – 6	9.6	3.9	4 – 20
DELE score	42.6	2.9	37 – 48	48.3	1.7	44 – 50
Self-ratings - English						
Speaking	9.5	.8	7 – 10	7.8	.89	6 – 10
Understanding	9.6	.7	8 – 10	8.4	.92	7 – 10
Reading	9.5	.7	8 – 10	8.3	1.06	5 – 10
Self-ratings - Spanish						
Speaking	8.6	1.1	6 – 10	n/a	n/a	n/a
Understanding	9.2	1.0	7 – 10	n/a	n/a	n/a
Reading	8.4	1.4	5 – 10	n/a	n/a	n/a

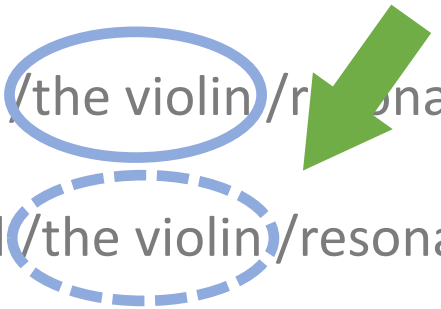
Materials: Eyetracking Stimuli

(a) *Transitive verb*
Cuando /el músico /tocó /el violín /resonó /por el salón.

(b) *Intransitive verb*
Cuando /el músico /llegó /el violín /resonó /por el salón.



Transitive verb
"When /the musician /played /the violin /resonated /through the hall."
Intransitive verb
"When /the musician /arrived /the violin /resonated /through the hall."



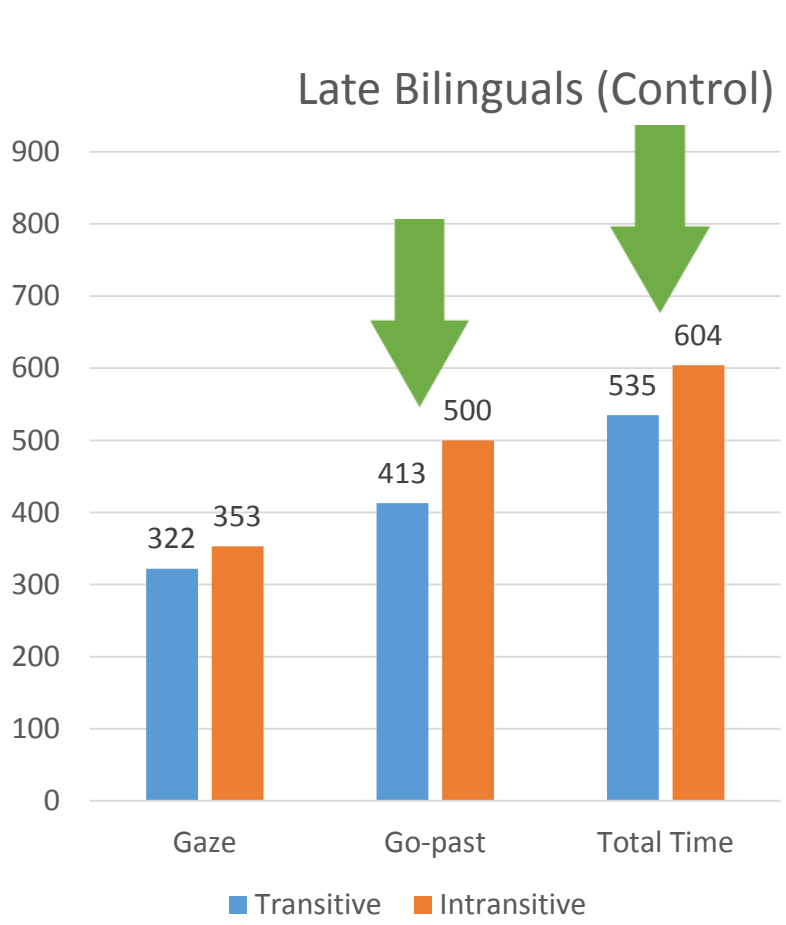
Procedure

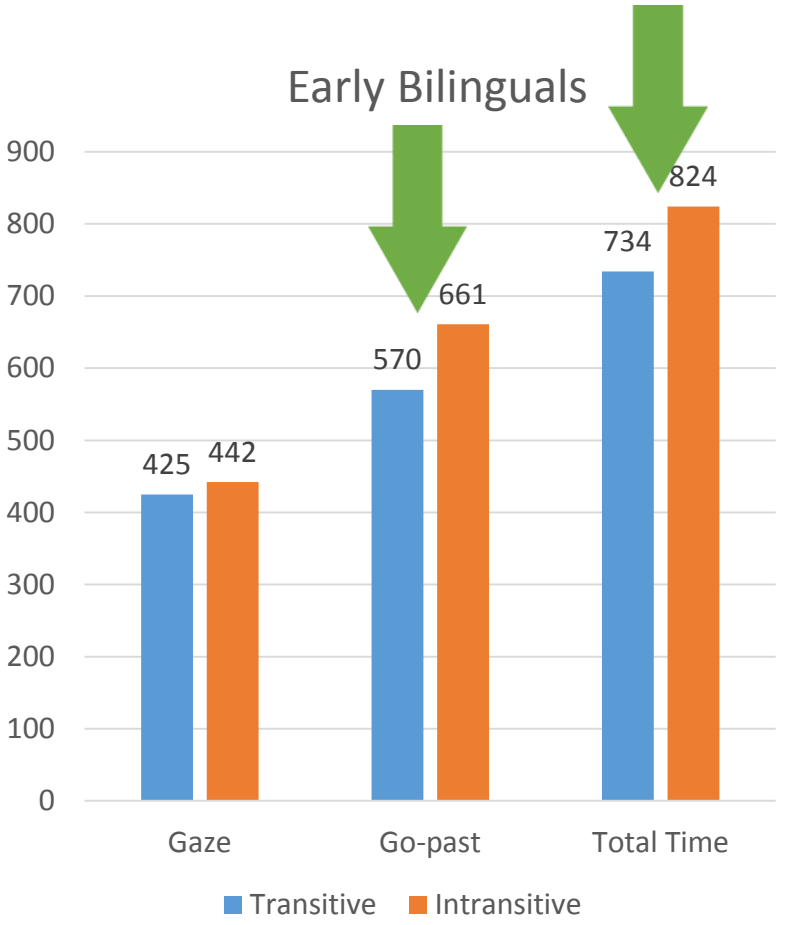
- Sentences read in their entirety (but divided as previously shown for purposes of analyses)
- 20 experimental sentences, 10 in each condition
- + 96 distractors, also 8 practice items
- Each stimulus was followed by a yes/no comprehension question to ensure that participants read for meaning

Eyetracking Measures

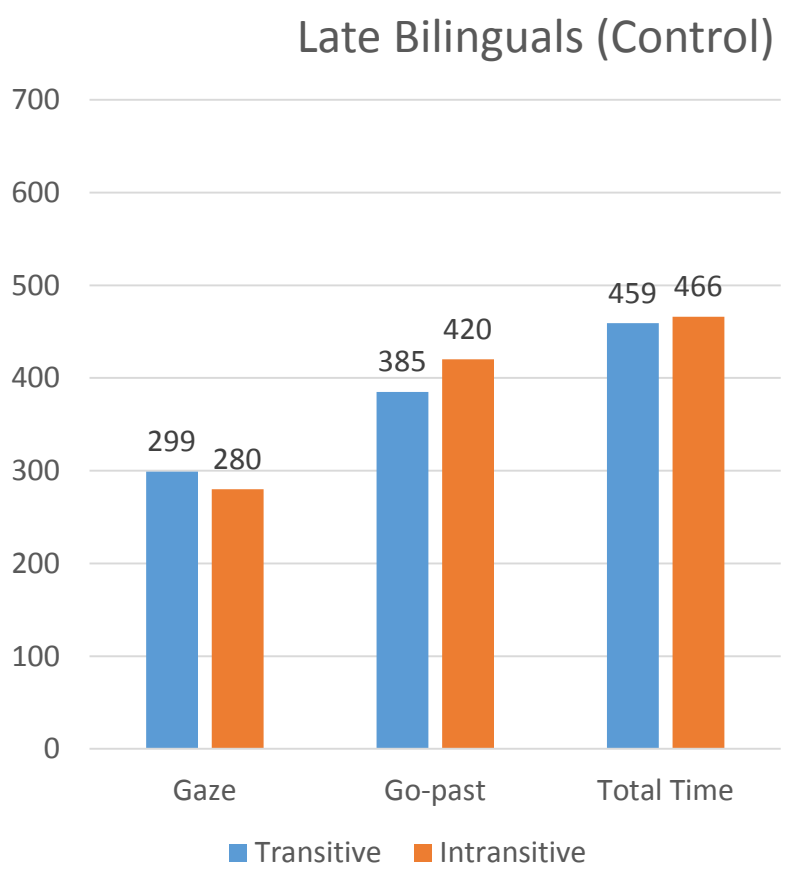
- Records fixation times (ms); allows re-reading
- Reading times can be fractionated into early, late, and 'hybrid' measures:
  - **gaze durations (early):** The sum of all fixations that a reader makes in a ROI from first entering it from the left until exiting it to the right or the left.
  - **go-past time (hybrid):** Begins with the first fixation a reader makes in a ROI and includes any additional fixations the reader makes before exiting the ROI to the right, including any re-fixations of words prior to the ROI if regressions were made.
  - **total time (late):** sum of all fixations made on the ROI

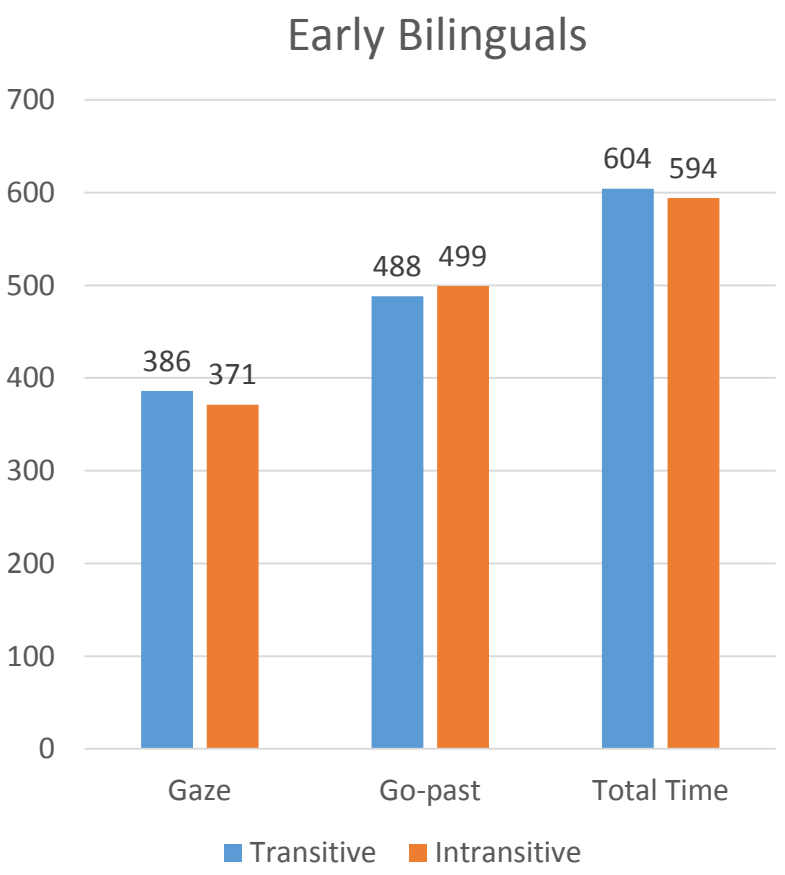
Results: Critical NP (el violín)





Results: Spillover verb (resonó)





Discussion: Experiment 2

Results summary:

- Both groups showed the expected effect at the post-verbal NP – Late Closure during processing – in go-past and total times (but not gaze durations)
- Unlike in the SPR experiment, the effect did not carry into the spillover region among heritage speakers

Discussion: Experiment 2

These results suggest that…

- HSs and late bilinguals experience comparable levels of difficulty (as measured by eyetracking); and
- That both groups engage in re-reading as a recovery strategy (e.g., effects found in go-past and total times)

General Discussion

- HSs may be more reliant on the ability to re-read that is available in eyetracking (and normal reading) but not in SPR, at least in this particular experiment with these stimuli
- SPR and eyetracking can each be uniquely informative, which underscores the importance of employing a range of different research methods with heritage speakers

Acknowledgement

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References

Benmamoun, E., Montrul, S., & Polinsky, M. (2010). White paper: Prolegomena to heritage linguistics. National Heritage Language Resource Center. Retrieved from http://nhlrc.ucla.edu/pdf/hl-whitepaper.pdf

Bolger, P. A., & Zapata, G. C. (2011). Psycholinguistic approaches to language processing in heritage speakers. *Heritage Language Journal, 8*, 1-29.

Carreira, M., & Kagan, O. (2011). The results of the National Heritage Language Survey: Implications for teaching, curriculum design, and professional development. *Foreign Language Annals, 44*(1), 40-64.

Frazier, L., & Fodor, J. D. (1978). The sausage machine: A new two-stage parsing model. *Cognition, 6*(4), 291-325.

Jegerski, J. (2018). Psycholinguistic perspectives on Spanish as a heritage language. In K. Potowski (Ed.), *Routledge handbook of Spanish as a heritage/minority language* (pp. 221-234). New York: Routledge.