

# The Influence of English on Spanish Sentence Comprehension among Early Spanish-English Bilinguals

Gabriel Campoverde<sup>1,2</sup>, Ibaña Vargas<sup>1,3</sup>, Stephanie I. Pérez<sup>1</sup>, Wendy Ramirez<sup>1,4</sup>, Erika Varela<sup>1,4</sup>, Eve Higby<sup>1,4</sup>

<sup>1</sup>The Graduate Center of the City University of New York, <sup>2</sup>Hunter College, City University of New York,

<sup>3</sup>St. John's University, <sup>4</sup>Queens College, City University of New York.

## Introduction

### Does knowledge of English influence Spanish sentence comprehension in early Spanish-English bilinguals?

- Causative sentences are present in English but not in Spanish.
- High proficiency Portuguese-English bilinguals comprehended causative constructions (ungrammatical in Portuguese but grammatical in English) as fast as English speakers (Fernandez and Souza, 2016).
- The aim of the current study was to determine whether early Spanish-English bilinguals process causative sentences in Spanish (which are technically ungrammatical) by using their knowledge of English grammar.

### Do early Spanish-English bilinguals show ERP components for grammatical or semantic violation for causative constructions in Spanish?

- ERP Components are present when the brain tries to make sense of language.
- Ungrammatical sentences elicit syntactic and semantic revision in language processing.
- Pseudo-causative constructions are ungrammatical in English and Spanish, these sentences function as control sentences, as well as transitive constructions which are grammatical in both English and Spanish.
- A Left Anterior Negativity (LAN) component is a fast, automatic syntactic analysis and initial detection of a syntactic error (Friederici et al., 2003)
- A P600 component is evident when a **syntactic** mismatch or anomaly during linguistic analysis occurs or when reanalysis of an initial syntactic structure is needed: an attempt to fix an error.
- An N400 component is observed when **semantic** anomalies are present.

## Predictions & Results

Direct Object Article	PSEUDO-CAUSATIVE		CAUSATIVE		Direct Object Noun	PSEUDO-CAUSATIVE		CAUSATIVE	
	Prediction	Findings	Prediction	Findings		Prediction	Findings	Prediction	Findings
LAN	✓	✓	X	✓	LAN	X	X	X	✓
N400	X	✓	X	X	N400	X	X	✓	X
P600	✓	X	X	X	P600	✓	X	✓	X

## Methods

### Participants

Early Spanish-English Bilinguals	Age 18-40	Age of Acquisition (years)	Language Proficiency (self rating)
N = 8	Mean 23.25	Spanish 0-2 y	Spanish: Mean=6.2 SD=0.06
	SD 4.03	English 2-8 y	English: Mean=6.4 SD=0.5

### Stimuli

#### Causative

Spanish X: *Los maestros trotaron a los niños alrededor del patio durante el recreo.*  
English ✓: *The teachers jogged the kids around the playground during recess.*

#### Pseudo-Causative

Spanish X: *Los maestros sudaron a los niños alrededor del patio durante el recreo.*  
English X: *The teachers sweated the kids around the playground during recess.*

#### Transitive

Spanish ✓: *Los maestros persiguieron a los niños alrededor del patio por diversión.*  
English ✓: *The teachers chased the kids around the playground for fun.*

\*5 participants heard 60 sentences for each condition and 3 heard 48 sentences for each condition.

### Data Acquisition

- EEG data collected from 128-channel electrode cap (EGI, Inc.)
- Sampling rate: 250 Hz
- Filter: 0.3-70 Hz (online), 0.3-30 Hz (offline)
- Reference: Cz (online), average reference (offline)
- Electrode impedances below 50 kΩ.
- EEG segmented at **(a) onset of the direct object article** and **(b) onset of the direct object noun**:

*The teachers jogged (a) the (b) kids around the playground during recess*  
*Los maestros trotaron (a) a los (b) niños alrededor del patio durante el recreo.*

### Task

- Naturalness judgment after each sentence
- Scale: 1= totally unnatural to 5= totally natural

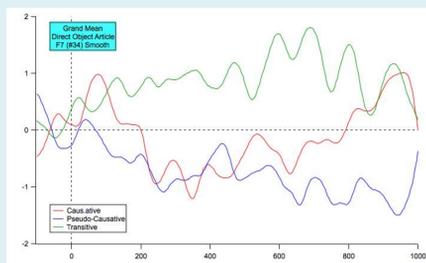
## Results

### Smoothed ERP Graphs

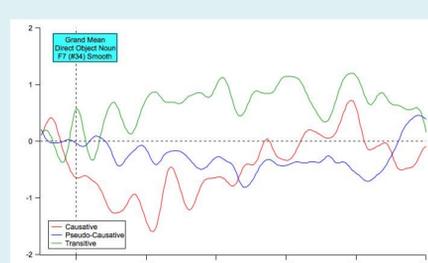
#### Direct Object Article

#### Direct Object Noun

Left Anterior Region

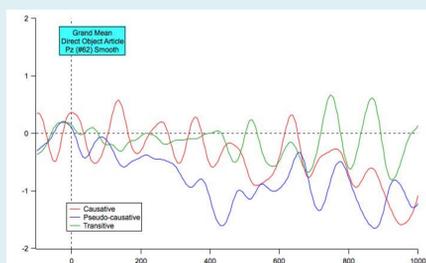


Left anterior negativity at 250-350 ms when grammatical violation is detected for pseudo-causative and causative conditions

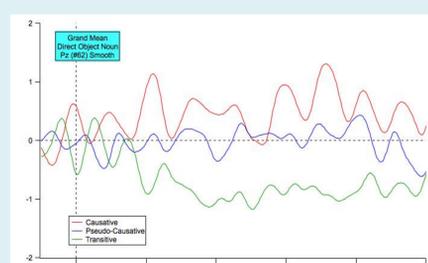


Left anterior negativity at 200 ms when grammatical violation is detected on the causative construction

Parietal Region



Negativity at 400 ms when semantic violation is detected for pseudo-causative construction



No N400 or P600 observed

### Naturalness Judgments



## Discussion

- Early Spanish-English bilinguals showed several ERP components.
- An N400 and LAN were observed while participants were listening to the pseudo-causative sentences while only a LAN was seen for causative sentences.
- At the direct object article in the causative construction, there is evidence of fast grammatical analysis (LAN). At the direct object noun we also found a fast detection of grammatical violation.
- In the pseudo-causative construction at the direct object article we found both LAN and N400. These suggest that there is a fast analysis of a grammatical error followed by detection of a semantic error. At the direct object noun for pseudo-causative construction we did not observe any ERP components.
- These findings suggest that bilinguals are using L2 syntax to process syntactic information in L1. Knowledge of English in early Spanish-English bilinguals influences Spanish sentence comprehension.

## References & Acknowledgments

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- Friederici, A. D., & Kotz, S. A. (2003). The brain basis of syntactic processes: Functional imaging and lesion studies. *NeuroImage*, 20, S8-S17.

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