Learning a second language influences first-language grammar processing

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MOTIVATION

- The native language grammar is assumed by many to be largely unchanging after initial grammar acquisition in early childhood.
- The current study explores whether bilinguals can use grammatical forms associated with verbs in their second language (L2) to understand ungrammatical sentences in their native language (L1). This would indicate that the native language allows grammatical transfer from the second language.
- Spanish-English bilinguals listened to ungrammatical sentences in Spanish that are grammatical in English (lexical causative construction).

ENGLISH: The teachers jogged the kids around the playground during recess.
SPANISH: Los maestros trotaron a los niños alrededor del patio durante el recreo.

- Event-Related Potentials (ERPs) were used to investigate at what point in the sentence bilinguals experienced comprehension difficulty, if at all.
- If listeners apply only the grammar rules of their native language Spanish, they should have difficulty forming an interpretation of the sentence when they counter the direct object (a los niños/the kids). We expect to see a LAN/P600 (if they detect primarily a grammatical problem) or N400 (if the difficulty is semantic integration).
- If listeners can apply grammar rules from either language to aid in comprehension, we expect to see these ERP components either largely reduced or absent.

DESIGN & MATERIALS

Stimuli
- **Causative** (Experimental) n = 48
  - *Los maestros trotaron a los niños alrededor del patio durante el recreo.*
  - *The teachers jogged the kids around the playground during recess.*
- **Pseudo-causative** (Ungrammatical control) n = 48
  - *Los maestros sudaron a los niños alrededor del patio durante el recreo.*
  - *The teachers sweated the kids around the playground during recess.*
- **Transitive** (Grammatical control) n = 48
  - *Los maestros persiguieron a los niños alrededor del patio durante el recreo.*
  - *The teachers chased the kids around the playground during recess.*

Procedure
- All sentences were in Spanish, presented auditorily during EEG data acquisition.
- Participants rated the naturalness of each sentence (1 = unnatural, 5 = natural).
- Inter-trial interval = 1000 ms

Critical regions for EEG segmentation:

Los maestros trotaron a los niños alrededor del patio durante el recreo.

Stimuli
- Direct object article
- Direct object noun
- Preposition
The teachers jogged the kids around the playground during recess.

RESULTS

- **Direct object article**
  - Early bilinguals
  - Late bilinguals

- **Direct object noun**
  - Early bilinguals
  - Late bilinguals

- **Preposition**
  - Early bilinguals
  - Late bilinguals

SUMMARY

- Naturalness ratings were significantly higher for Causative sentences than Ungrammatical control sentences and there were no group differences.
- Causative sentences did not elicit a Left Anterior Negativity, N400, or P600 at the direct object. But Causative sentences elicited more negative waves ~300-500 ms after the onset of the preposition for both groups at mid posterior sites.

DISCUSSION

- At the direct object, bilinguals did not show common ERP markers (LAN, 400, P600) for Causatives, reflecting little comprehension difficulty to this point, while ungrammatical control sentences elicited markers of ungrammaticality (LAN, P600).
- After the onset of the preposition, both early and late bilinguals showed negative-going waveforms for Causative sentences. The preposition reinforces the manner-of-motion verb’s directional component and is a crucial component of English lexical causatives. This negativity may reflect difficulty incorporating the semantics of the motion event with the two event participants.
- The Causative pattern does not appear to reflect structural expectedness, but rather some semantic integration difficulty. This suggests that processing these sentences in the native language is not isolated to the use of the native grammar, but recruits second-language grammar knowledge.
- Data collection is currently ongoing from monolingual Spanish and monolingual English speakers for comparison.

PARTICIPANTS

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<thead>
<tr>
<th></th>
<th>Early bilinguals</th>
<th>Late bilinguals</th>
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<tbody>
<tr>
<td>N</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Age</td>
<td>25.1 (6.7), 18-38</td>
<td>28.7 (5.9), 18-37</td>
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<tr>
<td>Gender</td>
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<td>Age of English Acquisition</td>
<td>5.6 (1.9), 3-8</td>
<td>15.2 (3.6), 10-21</td>
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<td>Self-rated proficiency</td>
<td>1-7</td>
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<td>Verbal Fluency (Sp, En)</td>
<td>43.6, 55.9</td>
<td>50.6, 50.6</td>
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</tbody>
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DATA ACQUISITION
- EEG data collected from 64-channel or 128-channel electrode caps (EGI, Inc.)
- Frontal regions of interest (ROIs) identified using Principal Components Analysis. Data were averaged across electrodes within each ROI
- Sampling rate: 250 Hz
- Filter: 0.1-100 Hz (online), 0.3-30 Hz (offline)
- Reference: Cz (online), average reference (offline)

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