

Decoding within- & between-language lexical competition from intracranial EEG: a neurosurgical case report of a pediatric Spanish-English bilingual

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Introduction

Spoken word recognition proceeds through **immediate activation** of items in the mental lexicon which match the incoming acoustic signal



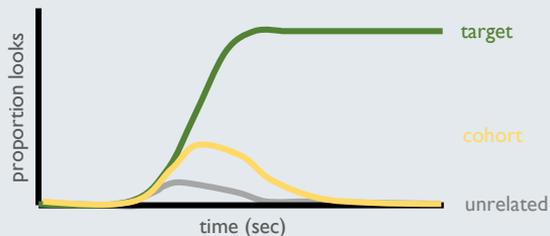
In **multilinguals**, possible competitor words comprise items across multiple lexica, e.g. the Spanish word *chanclas* (flip flops)



Goal

Previous eye-tracking work indicates that the strength of **early competitor activation** relates to:

- L1: developmental language trajectory Rigler et al (2015)
- L2: degree of language proficiency Blumenfeld & Marian (2007), Sarrett et al (2021)



→ However, the **underlying neural mechanisms** are not well known...

Methods

We present a case study of a **pediatric neurosurgical patient volunteer**:

- female, age 10
- right-handed & left language dominant
- Spanish-English bilingual (Spanish dominant)

Task

Passive listening to both **Spanish & English** words

Words were **cohort pairs** across 3 conditions:

- Spanish-Spanish (e.g. *pato* and *papas*)
- English-English (e.g. turkey and turtle)
- crosslinguistic (e.g. chalkboard and *chanclas*)

→ Can we **decode** what words a listener is considering over time, directly from neural activity?

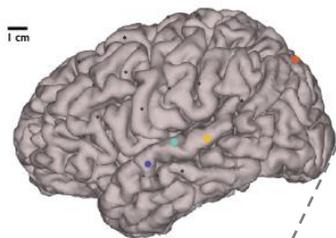
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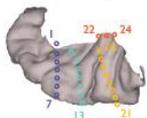
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Anatomy

Left hemisphere lateral surface



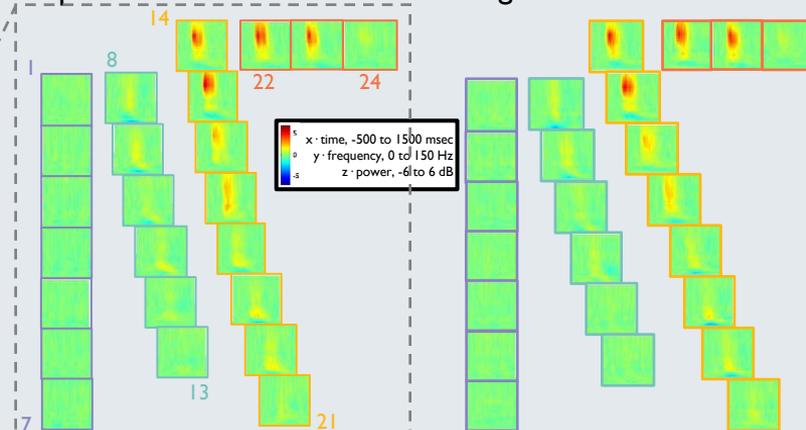
Left superior temporal plane



Time-frequency plots

Spanish words

English words



Machine learning

We utilized a **multi-class support vector machine (SVM)** at each timeslice post-stimulus onset to decode what word the participant was considering

This allowed us to examine **the pattern of confusions** as words unfold in time (e.g. is the SVM more likely to guess *chandas* when the word is “chalkboard”, compared to phonologically unrelated items)

We characterize both **within- and between-language lexical competition**, using two separate classification jobs trained on LFP slope and mean high gamma power on the superior temporal plane

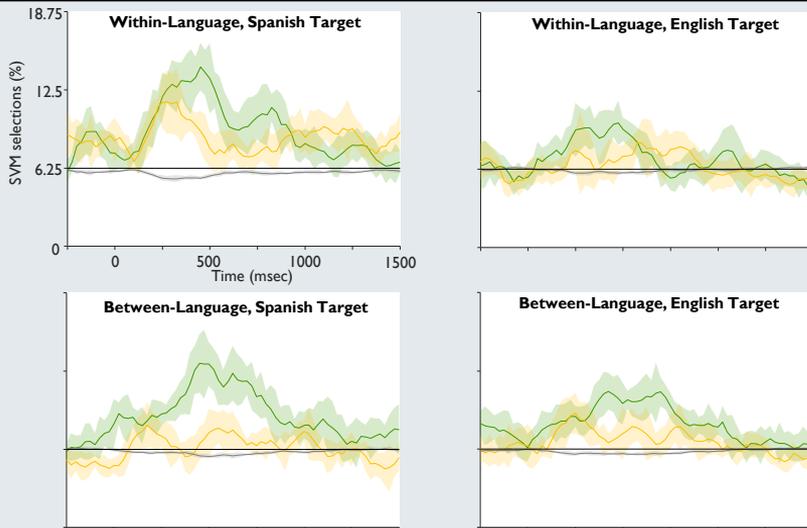
Rhone et al (submitted)

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Results



Conclusions

Spanish words are **more robustly decodable**, regardless of their role as a target word or as a competitor

English words are **less reliably decodable**, and show a less discernible profile of lexical competition (both within-language and cross-linguistically)

This is **consistent with a Spanish-dominant system** and corroborates evidence from eye-tracking

Discussion

Differences in lexical competition dynamics between the two languages suggests that early cohort activation may be in part due to **perceptual tuning of early auditory areas** for the sounds of a given language