

Effects of L2 knowledge into L1 speech perception: boundary movement in the vowel perceptual space

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L2-to-L1 effects in phonology

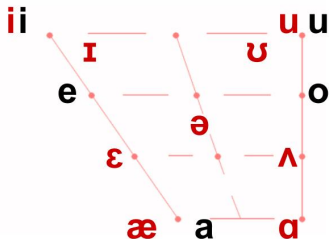
- There is much evidence proving L1-to-L2 effects in speech perception and production, but not viceversa
- Most (if not all) evidence comes from VOT measurements both in perception and production
 - In production:
 - Longer VOT in L1: early Japanese English bilinguals [Harada, 2003] and native French speakers of English [Flege, 1987]
 - In perception [Antoniou, Tyler & Best, 2012]:
 - Language mode [Grosjean, 2001] in bilinguals affects categorization, rating and discrimination of stops

Types of L2-to-L1 influences [Pavlenko, 2000]

- **Borrowing transfer:** addition of L2 elements to L1
- **Convergence:** Creation of a unitary system that is neither L1 nor L2, but two in one
- **Shift:** Move away from L1 parameters to adopt those of similar L2 structures
- **Restructuring transfer:** change, substitution or shift from L2 to L1
- **Attrition:** Loss of L1 elements due to L2 influence

Both convergence and shift have been attested in phonology.

Spanish and English vowel systems



- While Spanish only has 5 constant monophthong vowels (in black), English can even double this number, depending on the dialect (GAE in red).
- Some Eng vowels fall in the boundary between two native category areas in the acoustic space.

L2 categories: influence on L1

- L2 speakers of English create new categories by
 - splitting their L1 categories
 - sticking new L2 categories between two L1 categories
 - ...or maybe they don't create anything at all
- Assumption: L1 and L2 perceptual categories are in the same space.
 - Inserting new categories should rearrange the perceptual vowel space, as they will fall on the boundaries of the L1 categories.

Research questions

- Are there any boundary movements in the perceptual vowel space of the L1 as an effect of L2 proficiency?
- More specifically:
 - when speakers are confronted to the task of categorizing a nonnative vowel sound that falls between two native categories in the perceptual space...
 - in a native-like phonological context and language mode set in the L1...
 - ...will more proficient speakers start mapping English-like vowels onto native vowel categories in a different way than less proficient speakers?

Hypotheses

- Given the continuous nature of formant values in vowels (just like VOT in stops), movements in the boundary zones are expectable
- Preferences in forced categorization within L1 categories will change according to proficiency
- A different categorization choice of L2-like vowels within the native phonological system implies a change in boundary space between native categories.

Subjects

- 42 native speakers of Spanish from Chile (monolingual country, with very little contact with English speakers).
- Subjects completed an online self-assessment before starting the test, including:
 - Own perception of proficiency in specific tasks: reading, listening, speaking, writing
 - Background information: previous English instruction/immersion experiences, time of contact with the language, etc.
- The information considered 5 levels of proficiency, with 0 subjects on level 1 (no contact with the language at all)

Procedure

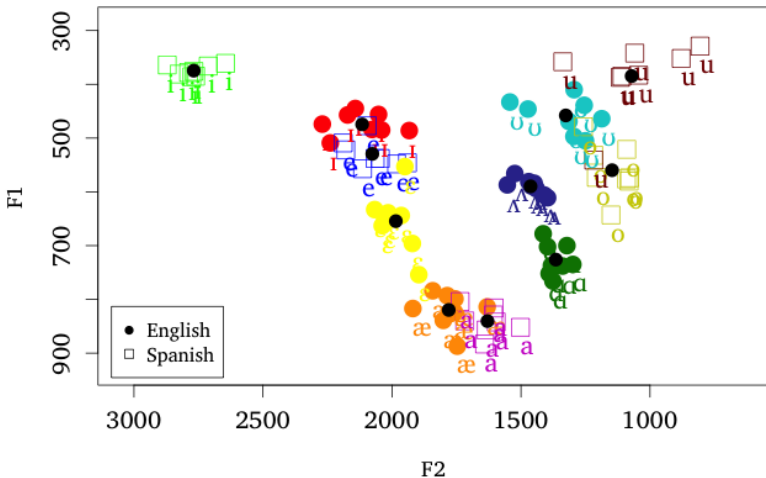
- Online survey platform (Limesurvey)
- Previous self-assessment of English command
 - Previous self assessment of English proficiency
- Task: Forced-choice categorization
 - Categories: the 5 Spanish vowels /i-e-a-o-u/
 - The subject was asked to categorize the vowel present in the stimulus
 - The survey was conducted entirely in Spanish

Stimuli

- 48 CVC nonce words, where C_C was a valid onset-coda combination in Spanish, and V was an English monophthong that
 - is physically located on the boundary of 2 or more Spanish vowel categories, and
 - is not present in Spanish.
- Stimuli were recorded by a trained bilingual speaker, under supervision of a native speaker of English.
- In order to compare formant frequencies of both English and Spanish vowels, a set of nonce words with Spanish vowels was constructed.

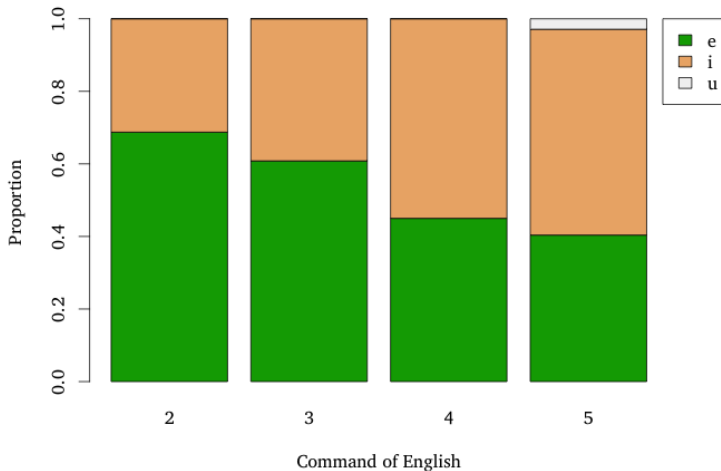
Stimuli

Formant values of English and Spanish vowels

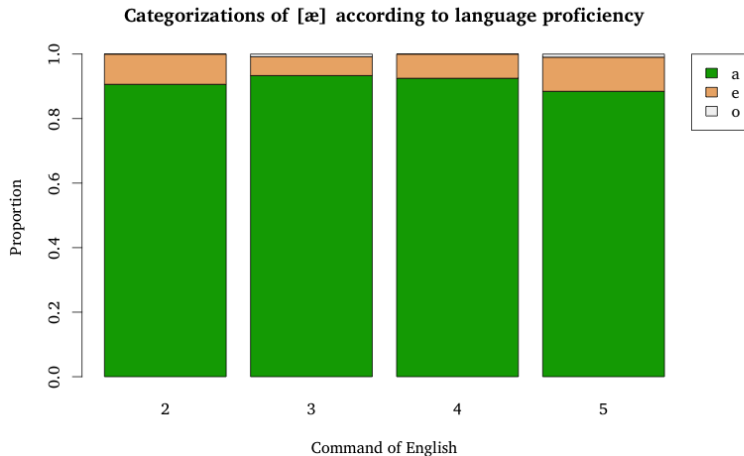


Results: /e-i/ boundary

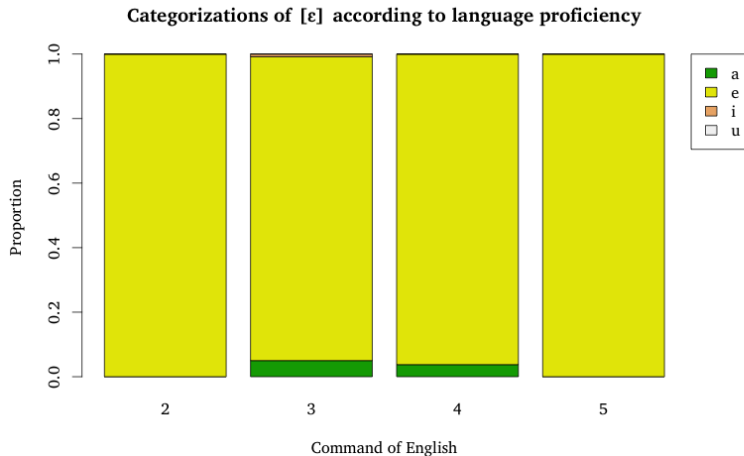
Categorizations of [ɪ] according to language proficiency



Results: /e-a/ boundary

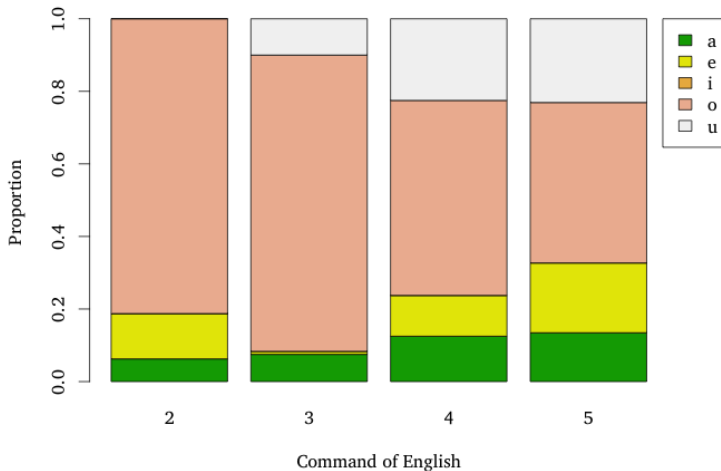


Results: /e-a/ boundary

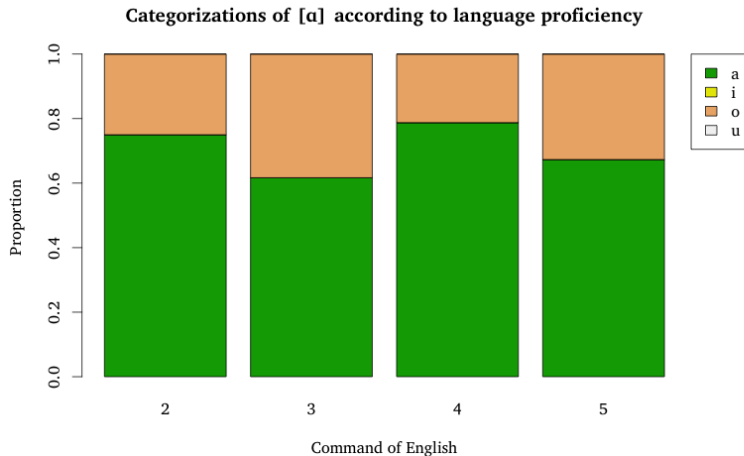


/a-o/ boundary

Categorizations of [Λ] according to language proficiency

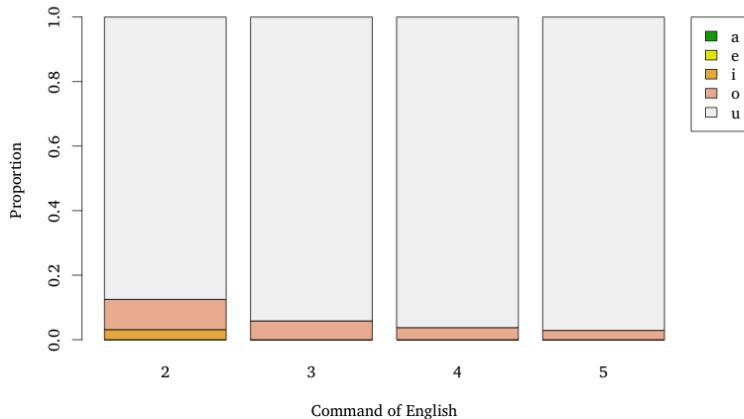


/a-o/ boundary



/o-u/ boundary

Categorizations of [ʊ] according to language proficiency



Summary

L2 Segment	p-value	Result
/ɪ/	0.002**	Movement in /i-e/ boundary
/ɛ/	0.208	No movement in /e-a/ boundary
/æ/	0.800	No movement in /e-a/ boundary
/ɑ/	0.065	No movement in /a-o/ boundary
/ʌ/	1.046e-07***	Movement in /e-a-o-u/ boundary
/ʊ/	0.053*	Movement in /o-u/ boundary

Table : p-values of Chi-square test between categorization choices and level of L2 knowledge

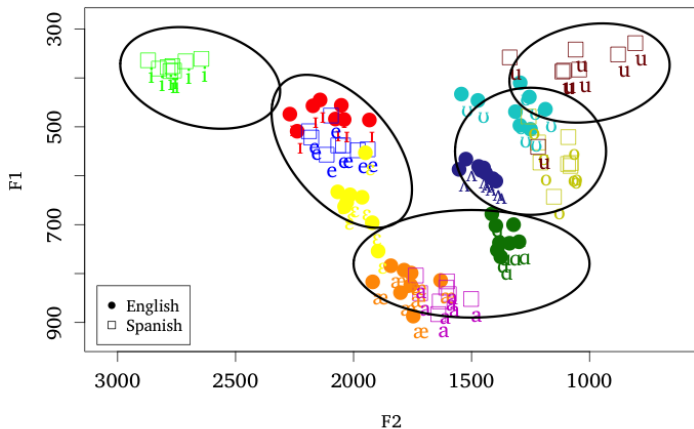
L1 perceptual categories, pre and post L2 learning

Boundary movement:

- /i/ accepts tokens with higher F1 values and lower F2 values.
- /e/ moves its upper boundary to lower F1 values.
- /u/ accepts tokens of /ʊ/, hence acquiring higher F1 values.
- /o/ is still the category that claims most of the /ʌ/ tokens, but advanced speakers are more likely to categorize it as either /e/, /a/, or /u/.

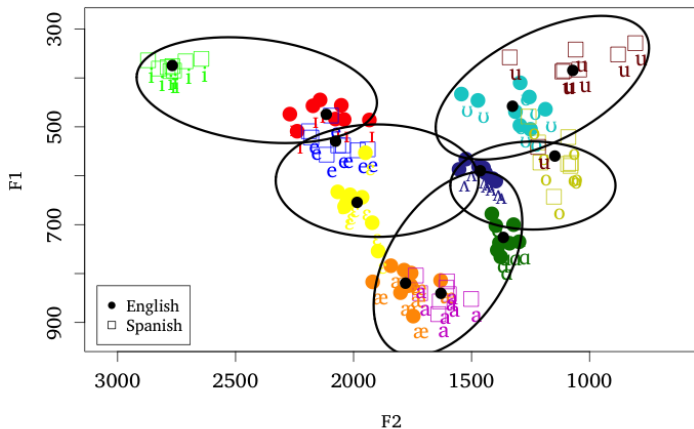
Before L2 learning

Initial state



After L2 learning

After L2 learning



Discussion

- Vowels that lie in the central part of the vowel trapezoid trigger redistribution
- Advanced speakers present warping effects, whereas beginners remain faithful
- Redistribution is symmetrical: boundaries move downwards and towards the center.

Discussion

- How do we explain the direction of the movement?
 - Orthographic effect
 - Regrouping by phonological family
 - Native category laxing
 - Continuous input of lax vowels raise awareness of centralized vowel values, but perhaps not enough to be perceived as different
 - Mapping of L2 onto L1 categories as default
 - Result: laxer L1 categories

Discussion

Implications:






- L2 speakers do not necessarily create new sound categories
- An L1 perceptual grammar must consider L2 influences
- Shift and convergence happens in the perceptual vowel space, and possibly in any continuous variable
- Input alone is important but not sufficient to explain L2 phenomena in phonology

Thank you

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References

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