


Diversifying articulatory phonetics through a bilingual and migrant lens: A look towards the future

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[BQ] Eskerrak eman nahi dizkiet konferentzia hau posible egin duten antolatzaile guztiei

[ENG] I would like to thank all the organizers who have made this conference possible

[ESP] Me gustaría dar las gracias a todos los organizadores que han hecho posible que esta conferencia sea posible

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[BQ] Poz eta ohore handia da etxera itzultzea eta hizkuntza gutxituak eta komunitate elebidunak ikusarazteko konferentzia honetan parte hartzea.

[ENG] It's a great joy and honor to return home and take part in a conference that gives voice to minority languages and bilingual communities.


[ESP] Es una gran alegría y honor volver a casa y participar en una conferencia que da voz a las lenguas minoritarias y a las comunidades bilingües.

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Outline

1. General problems
2. Articulatory approaches to speech
 - Classic and contemporary approaches
 - Contributions towards L2 speech
 - Working with underrepresented populations
3. Nasalization in bilingual and migrant speech
 - Vowel production
 - Consonant production
4. Future directions: The BAT Model



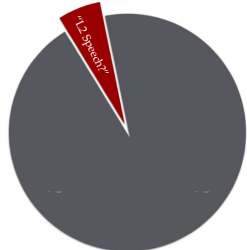
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General problems



General problems

- How much do we know about L2 speech acquisition?



Acoustic approaches
More focus on perception-based frameworks
Overreliance on 'WEIRD' populations
Western
Educated
Industrialized
Rich
Democratic



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General problems

- Articulatory phonetics is essential for understanding L2 acquisition **beyond perception**
- **Perception as a proxy** for articulation
- Proposed theories assume **very specific speakers'** linguistic skills as baseline
- There is a clear **need to diversify**:
 - Analytical approaches
 - Participant samples



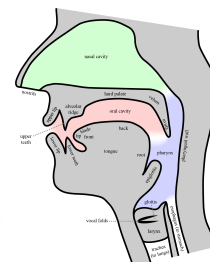
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Articulatory approaches to speech



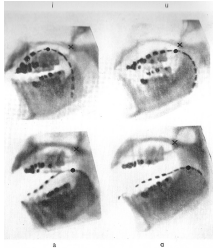
Classic and contemporary approaches

- **Nasal** gestures
- **Oral** gestures
- **Laryngeal** gestures
- **Entire vocal tract**
- Let's see real examples of how to analyze articulation
 - Shared with author's permission



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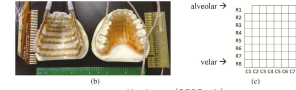
X-rays



Kochetov (2020a, b)

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Electropalatography (EPG)



Kochetov (2020a, b)

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Ultrasound (tongue imaging)



Kochetov (2020a, b)

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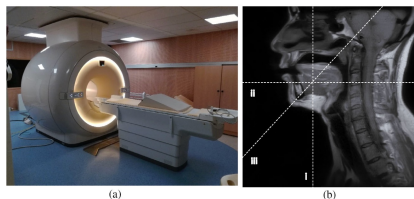
Airflow (aerodynamics)



Beristain (2023a, b)

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Magnetic Resonance Imaging (MRI)



Kochetov (2020a, b)

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Speech articulation theoretical models

- **L1-focused models:**
 - Numerical Model of Coarticulation (Öhman, 1967)
 - Task Dynamics (Saltzman, 1986)
 - Degree of Articulatory Constraint (Recasens, 1987)
 - Articulatory Phonology (Browman & Goldstein, 1992)
- **L2-oriented models:**
 - Articulatory Settings (Honikman, 1964)
 - Ontogeny Phylogeny Model (Major, 2001)
 - Speech Learning Model (Flege, 1995); Revised (Flege & Bohn, 2021)
 - Second Language Linguistic Perception (Escudero & Boersma, 2004)
 - Perceptual Assimilation Model-L2 (Best & Tyler, 2007)

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Addressing the gap in L2 articulatory research

Prior studies **lacked a direct framework** for predicting and describing speech data with regards to **L2 articulation**

Turning point:

Colantoni, Kochetov, and Steele (UToronto) proposed a **dedicated session on L2 articulatory approaches** in 2022 at the *10th International Symposium on the Acquisition of Second Language Speech* Special Issue published in *Language and Speech*



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Articulatory approaches to L2 speech

Bilinguals from Larynx to Lips: Exploring Bilingual Articulatory Strategies with **Anatomic MRI Data**

Pierre Bado Thomas R. Sawallo L. J. and Laurent Lamalle [View all authors and affiliations](#)

Gestural Timing Patterns of Nasality in **Highly Proficient** Spanish Learners of English **Aerodynamic Evidence**

André Berstein [View all authors and affiliations](#)

Production of the English /r/ by Mandarin-English Bilingual Speakers

Shuwen Chen D. H. Whalen and Peggy Pk. H. Mok [View all authors and affiliations](#)

Acoustic and Articulatory Visual Feedback in Classroom L2 Vowel Remediation

Tanja Kocjančič Tomislav Bolić and Susanna Hoffmann [View all authors and affiliations](#)

Articulatory Insights into the L2 Acquisition of English-/r/ Allophony

Laura Colantoni, Alexei Kochetov, and Jeffrey Steele [View all authors and affiliations](#)

The Articulatory and Acoustic Representation of **Second-Language French Vowels**

Madeleine Oakley [View all authors and affiliations](#)



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Methodological advances

- MRI, ultrasound, EPG, aerodynamic approaches show **gesture-level analysis**
- Visual **feedback tools** (ultrasound, formant tracking) **aid L2 learning**
 - Kocjančič et al. (2024)
- Combining acoustic and articulatory data challenges **acoustics-only theories**
 - Kocjančič et al. (2024); Oakley (2024)



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Common findings

Proficiency level boosts L2 performance
Beristain (2023); Chen et al. (2024)

Articulatory feedback and training enhance learning outcomes
Kocjančič et al. (2024)

Individual strategies and language background shape articulation
Beristain (2023); Oakley (2024)



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Theoretical insights

- **Crosslinguistic transfer** is pervasive but variable
 - Beristain (2023); Colantoni et al. (2023); Oakley (2024)
- While **phonetic similarity** facilitates L2 acquisition, dissimilarity challenges it
 - Chen et al. (2024)
- Learners form **interlanguage articulatory categories**, not just acoustic matches
 - Beristain (2023); Oakley (2024)



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Implications for theory and practice for bilingualism

Support for **usage-based models**
Frequent, meaningful exposure helps restructure L2 gestures

Bilingual speech shows **gradual integration** of L2 gestures
Conditioned by L1 norms
Affected by L2 experience



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Working with underrepresented communities

L2 and Heritage acquisition

- Spanish-English in USA
- Vowel nasalization
- Bilingualism degree:
 - Advanced (n=10)
 - Intermediate (n=16)
 - Heritage (n=16)

Rural → Urban long-term migration

- Spanish-Basque in Spain
- Consonant nasalization
- Migrant generation
 - G1, 80-90 y.o (n=6)
 - G2, 37-61 y.o (n=6)
 - G3, 25-33 y.o (n=6)



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Culturally responsive fieldwork methods

- Build rapport and trust with participants
- Engage with local community members and leaders
- Be transparent about research goals and data use
- Include community feedback in research design and dissemination
- Foster a supportive, non-judgmental environment
- Offer flexible scheduling and participation formats
- Use clear, low-effort visual and audio stimuli



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Nasalization in bilingual and migrant speech



Aerodynamics as a research technique

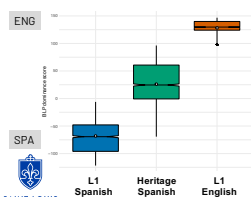
- Speech aerodynamics refers to the dynamics (i.e., flow) or air passing through the vocal tract and exhaling it through the oral or nasal apertures.
- Yu et al. (2022) list four measurable aerodynamic parameters involved in speech production:
 - subglottal pressure
 - intraoral pressure
 - oral airflow
 - nasal airflow



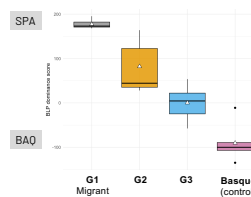
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Language dominance in bilingual settings

L2 and Heritage acquisition in USA



Rural → Urban setting long-term migration in Spain



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Language dominance in bilingual settings

L2 and Heritage acquisition in USA

- Chicago, Illinois



Rural → Urban setting long-term migration in Spain

- Extremadura → Basque Country (monolingual) (bilingual)



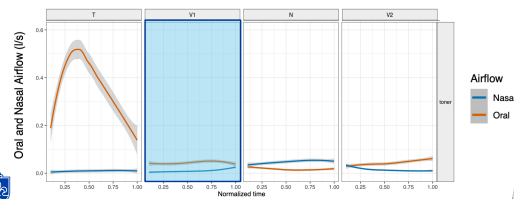
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Vowel production

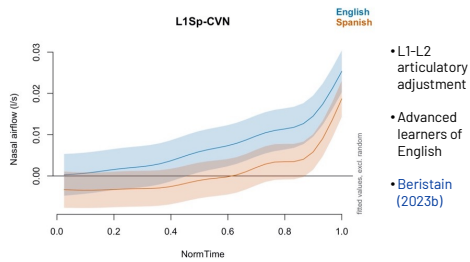
- Nasalization of vowels in **V-N sequences** in English and Spanish bilinguals

English	Spanish
teen	patín 'rollerblade'
tone	botón 'button'
tune	atún 'tuna'
- English has been described as **more nasal** than Spanish (Solé, 1992)
- Analysis of **airflow dynamics** across segment

Analysis: "t-o-n-er"

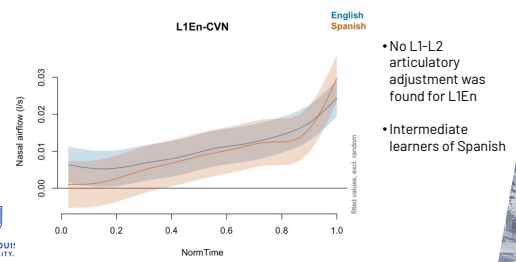


Results: L1 Spanish L2 English (advanced)



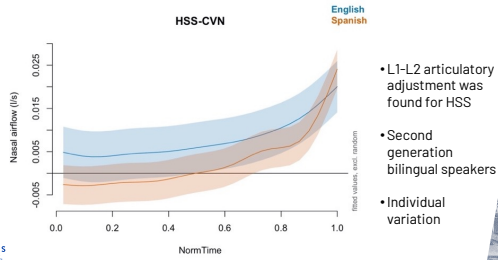
- L1-L2 articulatory adjustment
- Advanced learners of English
- Beristain (2023b)

Results: L1 English L2 Spanish (intermediate)



- No L1-L2 articulatory adjustment was found for L1En
- Intermediate learners of Spanish

Results: HL Spanish L2 English (advanced)



- L1-L2 articulatory adjustment was found for HSS
- Second generation bilingual speakers
- Individual variation

Consonant production



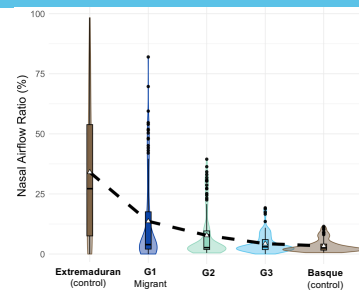
Consonant production

- Nasalization of fricative /x/ in /mVx/ sequences in Spanish
 - mejor* 'better'
 - mojar* 'to wet'
- Impressionistic studies documented /x/ nasalization in southern, more rural varieties of Spanish in Spain in nasal (e.g. *mejor*) and non-nasal (e.g. *hijo*) contexts
 - Rodríguez-Castellano (1948); Cummins (1974)
- Nasalization ratio in segment



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Results: Aerodynamics of fricative nasalization



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Common Findings

- Articulatory accommodation is pervasive in bilingual settings
- Language background shapes phonetic production
 - Languages in contact
 - Dialects in contact
- Social background plays a vital role on dialectal variability



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Future directions: The BAT Model



A proposal: The BAT model

Bilingual Articulatory Timing

A dynamic model of speech gesture development



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Considerations of the BAT Model I

Bilingual speakers, or speakers in bilingual settings, can adapt their native articulatory systems across the lifespan

Phonetic and phonological properties of L1 gestures may influence L2 production

Speakers construct interlanguage articulatory categories, whose plasticity/flexibility is influenced by:

- The degree of similarity between L1 and L2
- The phonological status of the feature



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Considerations of the BAT Model II

- Individual speaker's differences to be accounted for in predictions:
 - (socio)Linguistic background
 - Proficiency in L2
- 'Direction' of change in feature is a determining factor of the success rate:
 - Enhancement is an easier acquisitional 'challenge'
 - Follows many historical sound change examples
 - E.g. VN > ṼN > ṼN > Ṽ
 - Suppression may pose greater articulatory resistance
 - Yet there is evidence, e.g., denasalization in French



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Operationalizing the BAT Model



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Take-home message

- To understand second or L_n sound acquisition globally we need an **articulatory perspective** in addition to other domains
- Articulatory **gestures** are dynamic and adaptable within speakers and across languages
- Learners may build **interlanguage articulatory categories** before reaching target-like forms
- A full account must **bridge physiology and experience**, capturing:
 - Linguistic background
 - L2 exposure
 - Individual variability



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Eskerrik asko!

Thank you!

Gracias!



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Q & A

Any **comments**? Contact me at:
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anderberistain.com

For **handout**, check also:
<https://tinyurl.com/beristain-isb15>



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