Spanish Resyllabification in Child and Adult Heritage Speakers

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Introduction

Heritage Speakers

A heritage language (HL) is socio-politically a minority language, acquired as a first language during the first years of life, in the case of sequential bilinguals, or simultaneously with the majority language since birth, in the case of simultaneous bilinguals (Benmamoun, Montrul, & Polinsky, 2013; Montrul, 2002, 2008; Montrul, Bhatt, & Bhatia, 2012; Valdés, 2014)

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Segmental

Vowels (Ronquest, 2012, 2013; Willis, 2005), voiced and voiceless stops (Amengual, 2012; J. Kim, 2011; Rao, 2014), rhotics (Amengual, 2016; Henriksen, 2015; J. Kim & Repiso Puigdelliura, 2019)

Suprasegmental

Syllabification (Shelton, 2017), pitch accent inventories (Rao, 2016; Robles-Puente, 2014), lexical stress (J. Kim, 2019), prosodic prominence (Kim, 2020).

The Missing Link

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- Deceleration in acquisition: CHILD < ADULT
  Adult HSs outperform child HSs in the production of DOM (Montrul & Sánchez-Walker, 2013)
- Halted development: CHILD = ADULT
  Same patterns of instability in children aged 6 than in adults in morphosyntactic domain (Silva-Corvalán, 2018)

Resyllabification

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At the phrase level Spanish and English phonologies have a dispreference for empty onsets.

Resyllabification

- Spanish resyllabification

[un.o.so] becomes [u.no.so] ‘a bear’

(Colina, 1997; Harris, 1983; Hualde, 2014).

Resyllabification and Glottalization

- English
- Resyllabification (ambisyllabicity)
  [an.a.vo.ca.do] becomes [a.na.vo.ca.do]
  (Ito & Mester, 2009; Kahn, 1976)
- Glottal stop insertion
  [an.e.le.phant] becomes [an.ʔe.le.phant] (Davidson & Erker, 2014; Dilley, Shattuck-Hufnagel, & Ostendorf, 1996; Garellek, 2014; Pak, 2014; Scarpace, 2017; Scobbie & Pouplier, 2010)

Acquisition of Resyllabification

Lleó (2016) examines Spanish child heritage speakers (German majority language) and Spanish monolinguals.

2 Spanish monolinguals:

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	young Spanish-German bilinguals	older Spanish-German bilinguals
N	3	16
Age	2 - 5;7	7-8
% Resyll	between 33% and 40%	between 20% and 40%

Resyllabification Rates

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Resyllabification Rates

Results indicate arrested development. However, no group of adult heritage speakers to examine the outcomes of HL development.

Research Questions

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1. Does lexical stress have an effect on amount resyllabification in child and adult heritage speakers?
   (I) Lexical Stress Sensitive Empty Onsets Resolution: Stressed initial syllables (árbol) $<$ Unstressed initial syllables (animal)
   (II) Non-Lexical Stress Sensitive Empty Onsets Resolution: Stressed initial syllables (árbol) $=$ Unstressed initial syllables (animal)

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   (II) Non-Lexical Stress Sensitive Empty Onsets Resolution: Stressed initial syllables (árbol) $=$ Unstressed initial syllables (animal)
2. How can the development of resyllabification be best characterized between childhood and adulthood in Spanish as a heritage language?
   (I) Attrition: CHILD HSs $>$ ADULT HSs
   (II) Delayed development: CHILD HSs $<$ ADULT HSs
   (III) No differences in development (arrested development or complete development): CHILD HSs $=$ ADULT HSs

Methodology

Participants

Child HSs: 17 child heritage speakers (11 F, 6 M, Mean age= 9.67, SD= 0.5) enrolled in Spanish Language Immersion programs in two schools in West Los Angeles. Participants were exposed to Spanish at home and at least one of their caregivers came from a Spanish speaking country.

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Adult HSs: 15 adult heritage speakers (13 F, 2 M, Mean age= 20.40, SD=1.29) recruited from classes in the Spanish major at UCLA. English acquired either simultaneously (4 speakers) or sequentially (M= 4.43 years, 1.80, 10 speakers).

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Lexical Proficiency: VOCD (McCarthy Jarvis, 2007) and the number of different words in the first 100 words (NDW).

VOCD: independent-samples t-test: $t\ (26.15) = 1.93$, $p = 0.65$)

NDW: independent-samples $t(28.25) = 0.98$, $p = 0.33$)

Data Collection

Semi-spontaneous speech was elicited using the picture book, *Frog Where Are you?* (Mayer, 1969) (*oso* ‘bear’, *hoyo* ‘hole‘’, *árbol* ‘tree’, *animal* ‘animal’, *abejas* ‘bees’).

Data Preparation

The data was force-aligned using EasyAlign (Goldman, 2011) and Praat (Boersma Weenick, 2019). All instances of C#V were extracted from the data (N= 559). 21 tokens discarded due to pauses longer than 150ms (Scarpace, 2017) or global creakiness.

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Following Davidson and Erker (2014):

Modal phonation: vibration of the vocal folds is periodic with complete closing of glottis.

Glottal phonation: vocal folds are close together, vibration is irregular and at a lower frequency.

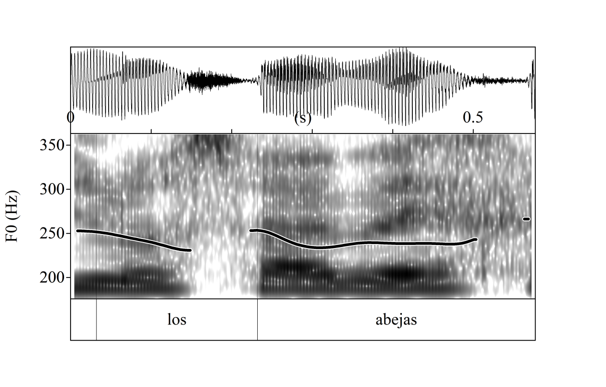
- Creaky phonation: high degree of pulse-to-pulse irregularity and amplitude irregularity
- Glottal stop: complete obstruction of the airflow in the glottis

Amount of modal phonation = amount of resyllabification

Amount of glottal phonation = amount of glottal stop insertion

Categorical Coding

Modal: modal voice through the consonant and vocalic sequence

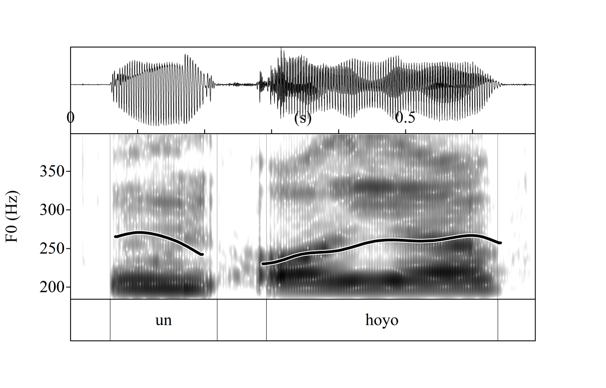


Modal phonation

modal

Categorical Coding

Glottal stop: period of silence shorter than 150 ms between the consonant and the vowel sequence

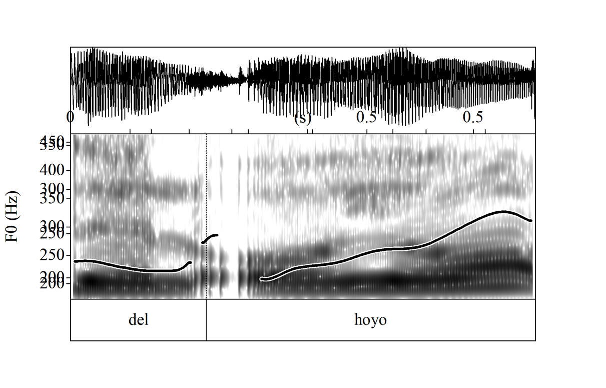


Glottal stops

glottal

Categorical Coding

Creakiness: aperiodicity in the speech signal



Creakiness

creaky

Acoustic Measures

(I) Harmonics-to-Noise Ratio
Harmonics-to-Noise-Ratio (HNR) calculates the amount of noise in the speech signal. HNR correlates with prominent glottal noise (Keating, Garellek, & Kreiman, 2015).
$\downarrow$ HNR $\downarrow$ modal phonation ($\uparrow$ glottal phonation)
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Acoustic measures extracted ith the ProsodyPro script (Xu, 2013)

Acoustic Measures

(II) H1-H2* Glottal phonation realized with ↑ amplitude in the H2 than H1 (negative values) (Garellek, 2014; J. Y. Kim, 2017).

↓ H1-H2* ↓ modal phonation (↑ glottal phonation)

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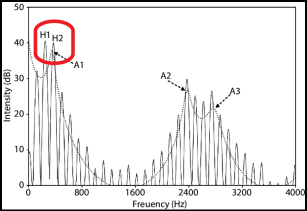

Source: Armostrong, Henriksen & DiCanio (2015)

Acoustic measures extracted ith the ProsodyPro script (Xu, 2013)

Results

Categorical Data Analysis

Generalized linear mixed-effects model: modal.phonation $\sim stress + group + (1|participant) + (1|word1) + (1|word2)(lme4(Bates, Mächler, Bolker,\ \& Walker,\ 2015))$

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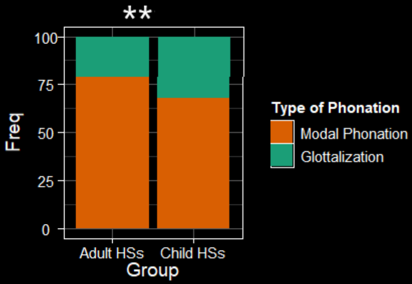
Child HSs produce less modal phonation than adult Hss (Estimate = -0.45, SE= 0.14, z =-2.92, p< 0.01)



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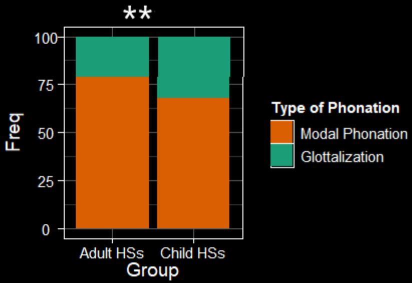
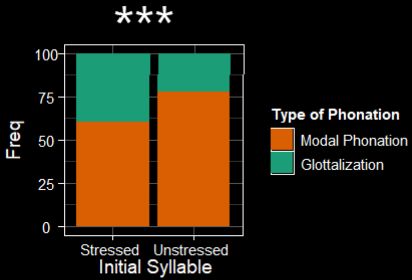
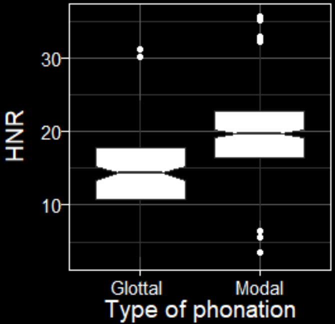
Unstressed syllables are produced with more modal phonation than stressed syllables (Estimate = 0.62, SE = 0.14, z= 4.50, p< 0.01)





HNR as a Proxy

(Estimate = 4.8616 , SE= 0.4553, $t = 10.68$, $p < 0.01$)



HNR

Linear mixed-effects model: harmonicity.z
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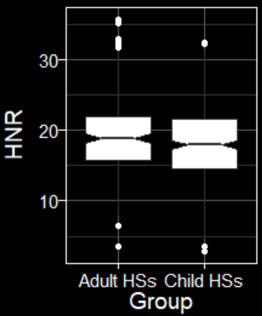
Child HSs showed sig. lower HNR values (M= 17.99, SD = 5.50) than adult HSs (M= 18.99, SD= 5.60) (Estimate = -0.85, SE= 0.41, t =-2.07, $p < 0.05$)



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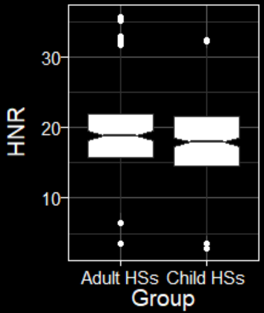
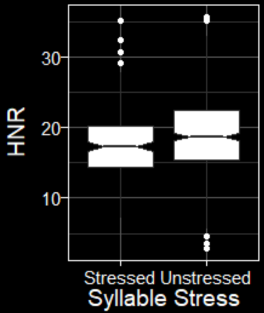
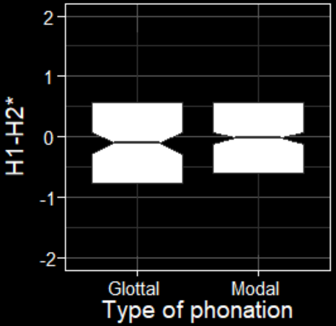
Stressed syllables showed lower HNR (M= 17.42, SD= 4.87) than unstressed syllables (M = 18.83, SD= 5.81) (Estimate = -0.85, SE= 0.41, t =-2.07, $p < 0.05$)





H1-H2 * as a Proxy

(Estimate = 0.26430 , SE=0.09607, $t = 2.751$, $p < 0.01$)



Continuous Data Analysis

lmer(h1h2*$\sim$ $stress + group + (1|participant) + (1|word1) + (1|word2)$)

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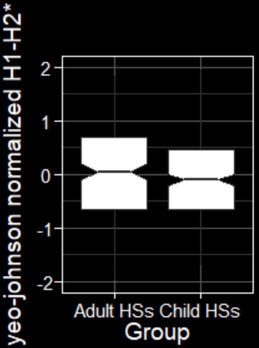

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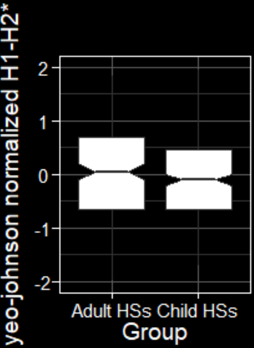
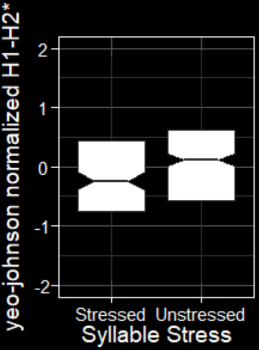
Stressed syllables showed lower values (M=-011, SD=0.50) than unstressed syllables (M=1.01, SD=0.05)(Estimate = 0.19, SE=0.09, t =1.91, p = 0.07)





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Effect of lexical stress in the English literature (Davidson & Erker, 2014; Dilley et al., 1996; Garellek, 2013).

Initial evidence that Spanish HSs incorporate English-like strategies to repair prosodically prominent empty onsets.

HSs exhibit flexibility when expressing prosodic prominence (Kim, 2020).

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However, future research should incorporate Spanish non-heritage grammars.

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Limitations and Further Research

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- Information about relative exposure to HL in the child HSs and the adult HSs groups.
- Resyllabification has been operationalized as modal phonation. Further studies should also measure degree of resyllabification (e.g. consonant duration).
- Acoustic measures: Results for this study indicate that HNR might be a better proxy than H1-H2*.

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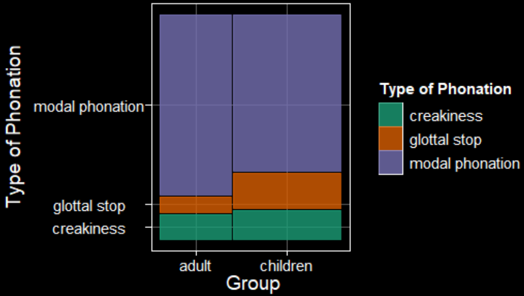
Distribution of Categories



Distribution of Type of Phonation

	adult HSs	child HSs
modal phonation	81.86	70.89
creakiness	11.16	13.00
glottal stop	6.97	16.09