Lexically-Conditioned Child Acquisition of English Empty Onset Repairs

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Constraint-Weighted Speech Learning Models

- Error-driven algorithms allow children to update their constraint set, initially dominated by Markedness constraints (Markednesss >> Faithfulness), when exposed to mature grammars (Boersma & Hayes, 2001; Demuth & Fee, 1995; Demuth, 1996; Gnanadesikan, 2004).
- Recent proposals in MaxEnt grammars introduce lexical frequency and the status of the lexicon to assess exceptionality and variation (Hsu & Jesney, 2017; Hughto et al., 2019; Moore-Cantwell & Pater, 2016; Pater et al., 2007).

Development of Empty Onset Repairs

- English word-external empty onsets (e.g., /C#V/ *all.apples*) → often repaired with ambisyllabic consonants, a resyllabification process that misaligns the left edge of the stem from the prosodic word (Align- L (stem, ω)) (Kahn, 1976; Rubach, 1996).
- Newton and Wells (2002) found an early stage of glottal stop insertion (Dep-ʔ) which became adult-like (15%) by 2;11.

/all onions/	DEP	Align-L	Onset	Max
a. ɔl.ʌnjons	0	-1	0	0
b. ɔl. ʔʌ.njons	-1	0	0	0
c. ɔɣ. ʌ.njons	0	0	-1	0
d. ɔɣ.njons	0	0	0	-1

/l/ Ambisyllabicity (Hayes, 2009)
- Ambisyllabic /l/: dark [ɫ] [+ back]
- Coda /l/: vowel-like gesture [ɣ] [+back] [-coronal]
- Glottal stop [ʔ] - epenthesis: [ɣ] + [ʔ]

Research Questions

- Do word-external empty onsets (i.e., /C#V/ sequences) continue to develop during late childhood?
- Is prosodic prominence (i.e., word-level stress) a predictor for type of repair of word-external empty onsets?
- Are repair types of word-external empty onsets predicted by the lexicon (new lexical items vs. known lexical items)?

Methods

16 function + content word sequences.

Real Words			
Primary stress	Log Freq	Non prim. stress	Log Freq
all octopi	1.28	all umbrellas	1.77
all islands	0.95	all aquariums	0.60
all onions	0.90	all iguanas	0.90
all olives	0.48	all avocados	0.00

Novel Words			
Primary stress	NFreq	Non prim. stress	NFreq
all adgies	2.275	all abeeds	0
all imbos	2.235	all iboons	2.118
all embos	0	all egoons	2.275
all ombies	0	all azeeds	0

Participants

24 English-speaking children (10M, 14F): (a) 12 younger children (6;5-8;8), (b) 12 older children (9-10;4).

Acoustic Analysis

- Ambisyllabic cons.: Modal phonation throughout /CV/ + consonantal gesture
- /ʔ/- epenthesis: presence of glottal phonation in /C#V/ or full glottal stop.
- Coda consonant: Modal phonation throughout /CV/ + l-vocalization (/l/ allophone found in coda position [Hayes, 2009]). L-vocalization was classified using perceptual coding (Hall-Lew & Fix, 2012)

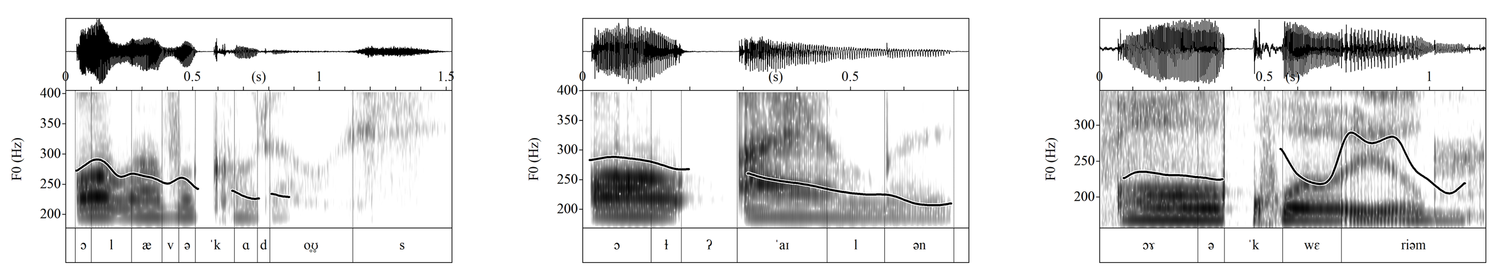
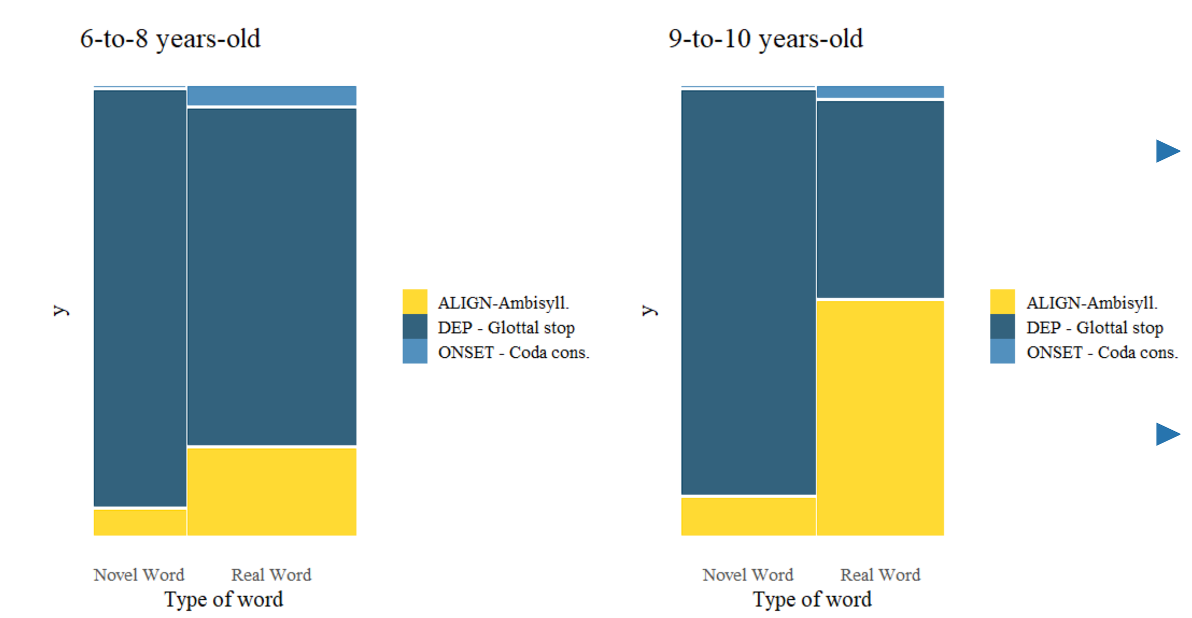


Figure 1: Ambisyll. (left), /ʔ/-epenthesis (center), Coda (right)

Results



- Repair type differed across age-groups (χ^2 (3, N = 24) = 11.39). 6-to-8-y.o > /ʔ/-epenthesis than 9-to-10 y.o. (p = 0.03). 9-to-10 y.o. > ambisyllabic cons. than 6-to-8 y.o.(p = 0.01).
- Repair type differed by type of word (real word- novel word) across age groups (CMH (3, N = 24) =20.28, p < 0.01). /ʔ/-epenthesis: novel words > real words (6-to-8-y.o.p = 0.03, 9-to-10-y.o. p < 0.01). Ambisyllabic cons.: real words > novel words (only sig. in 9-to-10 y.o. p < 0.01).
- Repair type differed by stress level (primary stress vs. not primary stress) across age groups (CMH (3, N = 24) =37.41, p < 0.01). /ʔ/-epenthesis: initial stress > non-initial stress (6-to-8-y.o.p < 0.01, 9-to-10-y.o. p < 0.01). Ambisyllabic cons.: non-initial stress > initial stress (6-to-8-y.o.p < 0.01, 9-to-10-y.o. p < 0.01).

Modeling the Data

- Scalar Align-L: Assign penalties to constraint violations as a function of lexical frequency (distance from the lexicon à la Hsu & Jesney 2017). Penalties fitted from data with Solver.
  - Sig. higher penalties for novel words (6-8 y.o. M = 7.1, 9.10 y.o. M = 10.6) than for real words (6-8 y.o. M = 2.7, 9.10 y.o. M = 1.1) (p = 0.03, p < 0.01). While not stat. sig. 9-10 y.o. have greater penalty differences (novel words - real words) than 6-8 y.o (6-8. y.o. M = 4.38, 9-10 y.o. M = 9.49, p = 0.09).
- Split Dep-ʔ: Assign a violation for each epenthetic /ʔ/ in the output in syllables with primary stress (DEP-ʔ(σ)) and syllables without primary stress DEP-ʔ(σ).

6-to-8-years-old

K-L ≈0.08	Ons.	DEP-ʔ(σ)	DEP-ʔ(σ)	Al.- L	Scalar Al.-L
Weights	5.34	0.00	2.27	2.34	1.01

Table 1: Compared to model without Scalar Align-L(K-L ≈0.56)(χ^2 (df = 17) = 5.54, p = 0.9)

9-to-10-years-old

K-L ≈0.24	Ons.	DEP-ʔ(σ)	DEP-ʔ(σ)	Al.- L	Scalar Al.-L
Weights	504	0.00	1.85	0.28	0.55

Table 2: Compared to model without Scalar Align-L(K-L ≈1.33)(χ^2 (df = 17) = 30.60, p = 0.04)

Discussion

- **Do repairs of empty onsets continue to develop during late childhood?** 6-to-8-y.o. produce a higher proportion of ʔ-epenthesis (M = 82.66 %) than 9-to-10-y.o (M = 68.86 %).
  - Repairs of empty onsets continue to develop past the age of ≈6.
  - Ambisyllabicity (misalignment in the syllabic structure) more costly than ʔ-epenthesis during childhood.
- **Does prosodic prominence predict the type of repair?** Words with initial prim. stress show greater rates of /ʔ/-epenthesis (M = 89.93 %) than words without initial prim. stress (M = 60.76 %).
  - Split Dep- ʔ constraint to account for prosodic prominence.
- **Does the lexicon predict the type of repair?**: Novel words show higher rates of /ʔ/-epenthesis (M = 92.80 %) than real words (M = 61.79 %).
  - Scalar Align-L shows that novel words are evaluated as more distant from the lexical core than real words in 6-8 y.o. and 9-10 y.o.'s grammars.

Selected References

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Acknowledgments

*Special thanks to Ji Young Kim, Victoria Mateu, Kie Zuraw, Claire Moore-Cantwell, and the members of the UCLA S&P Research Methods