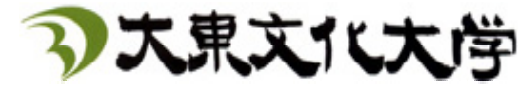




Voicing-dependent vowel duration in Japanese children



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Vowel duration: phonetics or grammar?

- Vowel is longer before voiced than voiceless consonant in L1
 - English:
 - Adult: House (1961), Mack (1982), 150%!
 - Children: Ko (2007)
 - Korean, Russian, French: Chen (1970), not to the degree of English.
 - Japanese: Not explored much.
 - Does English have a special grammar to elongate the vowel (e.g., Lisker, 1974)?
 - Or is it just a general phonetic mechanism (e.g., Lehiste, 1970)?

Determining factors

- House (1961): Vowel duration study of adult American English speakers**
- Investigated average durations of 12 vowels of American English in disyllabic nonsense words
- Target words: unstressed (carrier) syllable [hə] + stressed syllable (C¹VC²)
 - C1 and C2 should be the same phoneme (e.g., [həfɪf], [həvɪC])
 - 12 vowels [i, ɪ, e, ε, æ, a, ʌ, ɔ, ɜ, o, u, ʊ]
 - 14 consonants [f, v, θ, ð, s, z, tʃ, dʒ, p, b, t, d, k, g]
 - 14 (consonants) x 12 (vowels) = 168 words (no repetition)
- Three American English male speakers
- Four factors affecting vowel duration in English
 - Primary influences: a part of English phonology, acquired by native speakers
 - Character of context (post-vocalic voicing distinction: voiced/voiceless consonants)
 - Character of vowel (tense/lax vocalic distinction)
 - Secondary influences: a function of the articulatory process
 - Character of vowel (vowel height: close, mid and open vowels)
 - Character of context (consonant class: stops, affricates, fricatives)
- Claim:** Vowel durations in English are affected by both universal and language-specific characteristics of the post-vocalic consonants and the target vowels.

- Ko (2007): Vowel duration study of American English acquiring children**
- Investigated the acquisition of vowel duration in children speaking American English
- Especially when and how children acquire vowel durational differences as a function of postvocalic voicing
- Corpus: subset of the Province Corpus (included in the CHILDES database)
 - Four children: postvocalic vowel voiceless/voiced distinction
 - Three children: tense/lax vowel distinction
 - Age range: 0;11 to 4;0.
 - Target words
 - Varies (spontaneous speech corpus)
 - Minimal or near-minimal pairs of (C)VC (e.g., back-bag; duck-bug)
- Three findings
 - Vowel duration conditioned by voicing before the age of 2
 - Tense/lax vowel durational distinction acquired before the age of 2
 - No developmental trend in the acquisition of the vowel duration conditioned by postvocalic voicing.
- Claim:** Postvocalic consonant voicing distinction and tense/lax vowel distinction are universal, rather than language-specific characteristics, which conflicts with House (1961).

Research Question: Testing Ko (2007)

- Is the vowel duration conditioned by postvocalic consonant voicing universal or language-specific?
 - If the vowel duration difference before the postvocalic voiceless/voiced distinction is universal, we would expect that children speaking any language should show the same tendency as in Ko (1997).
- A corpus study of the Japanese-acquiring children was conducted.

Corpus Study: NTT infant database (Amano, Kondo & Kato (2008))

- Longitudinal data of spontaneous speech at home, subset of the data (3 of 5 speakers) were segmented and labeled.
- All children were born and raised in Tokyo and Kanagawa area.

Subject ID	Age range	Gender	Recorded hours
ma	0-60	F	51
sa	0-60	F	56
sk	0-54	M	67

Analysis by Target Words

- Postvocalic consonant effect: Vowels before voiced > Vowels before voiceless (Figure 1).
- Consonant class effect: Fricatives > Stops > Geminate stops (Figure 1).
- Effect of vowel height: Low > Mid > High (Figure 2).
- Phonological distinction of vowel length: Overlap? More analyses below (Figure 2).

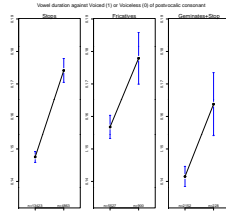


Figure 1

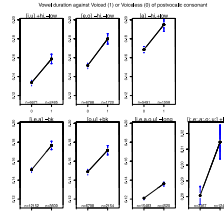


Figure 2

Analysis by Age

- Short vowels: Getting shorter from 30-40 months (Figure 3a).
- Long vowels: Huge variability across all ages (Figure 3b).

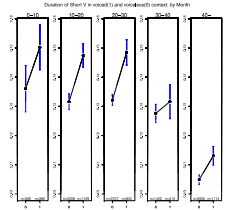


Figure 3a

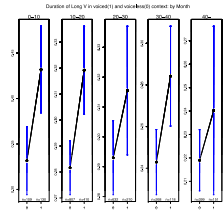


Figure 3b

Summary

- Both consonant class effect and vowel height effect are observed.
- Short/Long contrast is not stable yet.
- As for voicing dependent durational difference, Universal (Ko, 2007) beats Language specific (House, 1961) hypothesis.
- If so, does that universal property in L1 carry over to L2?

Preliminary Production Experiment in L2 English

- Question:** Do L1 Japanese speakers show "universal" vowel duration differences in L2 English?

Methods

- Materials**
 - 16 minimal pairs, ending with a voiced/voiceless consonant, 32 words in total
 - Taken from an English phonetic textbook for college students (Takebayashi and Saito, 2008)
 - [i]: beat – bead, peace – peas, feet – feed
 - [ɪ]: mitt – mid, lit – lid, sit – Sid, kit – kid, hiss – his
 - [e]: peck – peg, bet – bed, set – said
 - [æ]: batch – badge, cat – cad
 - [ʌ]: but – bud, bus – buzz, duck – dug, cup – cub
 - [ɔ]: mop – mob, knots – nods, got – god
 - [ʊ]: putting – pudding
 - [u]: proof – prove, leaf – leave, grief – griev
- Participants**
 - 15 students at Daito Bunka University (1 grad, 14 undergrads (sophomores, juniors and seniors))
- Procedures**
 - Pronounced each target word embedded in a career sentence, "Say _____ now."
 - Six times per target word, random presentation controlled by Praat (Boersma and Weenink, 2013).
- Measurements**
 - Exclude miss-pronounced words (e.g., "bead" pronounced as [bɛd], "cub" as [kʌb])
 - Start and end points of each target vowel were first segmented automatically, and manually corrected by the authors trained as phoneticians.

Analysis by Target Words

- Postvocalic consonant effect: Vowels before voiced consonants > Vowels before voiceless consonants (Figure 4)
- Consonant class effect in vowel durations: Fricatives > Affricates > Stops (Figure 4)
- Point of articulation effect on vowel durations before voiced consonants: Labials, Dorsals > Coronals (Figure 4)
- Effect of vowel height on vowel duration before voiced consonants: Low > Mid > High (Figure 5)
- Effect of tense/lax vowel distinction on vowel duration (Figure 5):
 - Tense > Lax
 - Postvocalic consonant effect maintained.

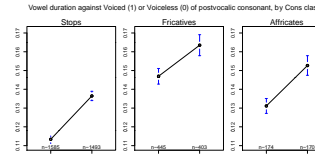


Figure 4

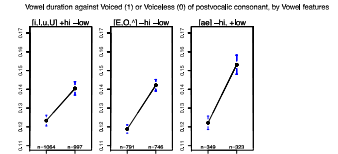


Figure 5

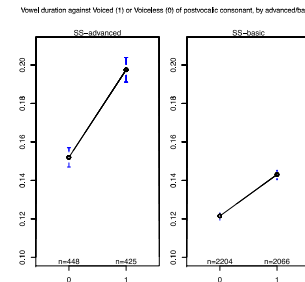


Figure 6

Analysis by Participants

- Categorized into two groups in terms of English speaking ability
 - Advanced group: SS1, SS7, SS16
 - Basic group: the rest
- Voiceless/voiced postvocalic consonant distinction (Figures 6 & 7).
- Group effect (Figure 6):
 - Overall vowel durations: Advanced > Basic
 - Voicing dependent duration difference: Advanced > Basic
- Almost all participants showed vowel durational difference between voiceless/voiced postvocalic consonant (Figure 7).

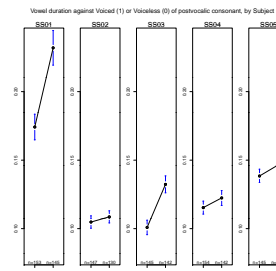


Figure 7a

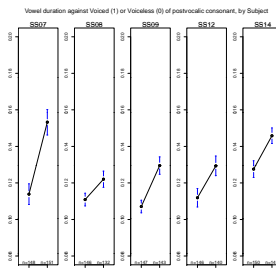


Figure 7b

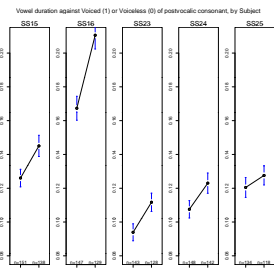


Figure 7c

Discussion and Conclusion

- The postvocalic voicing effect on vowel duration is universal. A corpus analysis of Japanese infant data supports this view.
- Universal durational differences do carry over to L2.
 - Voicing distinction
 - Consonant class
 - Vowel height
- Language specific durational difference {sits on top of | enhances | enlarges} the universal one.
- Needs a model for {adding | adjusting | multiplying} the parameter for the distinction in L2.
- L1 grammar works together with the development of language proficiency in L2.