Syllabification of vocoids in Malay: Evidence from musical text-setting

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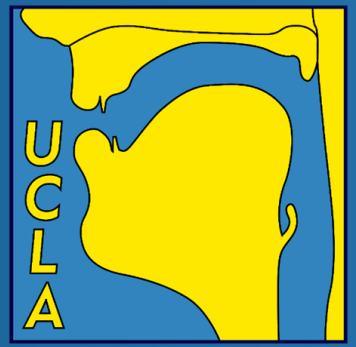

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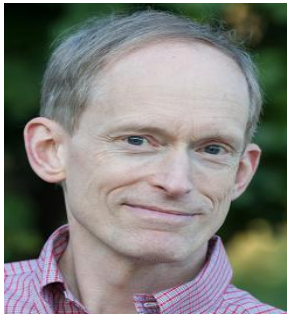
Bruce Hayes


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Audiences at:

1. LING 251A/B (*Phonology of Global Pop Music*)
2. 2026 LSA Annual Meeting
3. UCLA Phonology Seminar

Background

Malay

- Malay (*Bahasa Melayu*) belongs to the Western Malayo-Polynesian subgroup of the Austronesian language family (Blust 2013: 30-32).
- 60 million speakers across Maritime Southeast Asia (Brunei, Indonesia, Malaysia, Singapore).

Glides in Malay

- Phonemic status of glides in Malay:

1. Phonemic /j, w/ (Abdullah 1974; Yunus 1980; Farid 1980; Teoh 1994)
2. Derived from /i, u/ in syllable margins (Durand 1987; Ahmad 2005)

- Syllable structure: (C)V(C), with optional onsets and codas

- Vowel hiatus /V.V/ is actively repaired in multiple ways, depending on the vowel quality and morphological boundary involved.

  → morpheme-internal /i.a/ and /u.a/ sequences

Traditional analysis of hiatus resolution

- A hiatus involving a high vowel and /a/ is resolved via fission (Ahmad 2005: 32).

/bəru$_1$a$_2$ŋ/ ‘bear’

[bə.ru$_1$.w$_1$a$_2$ŋ]

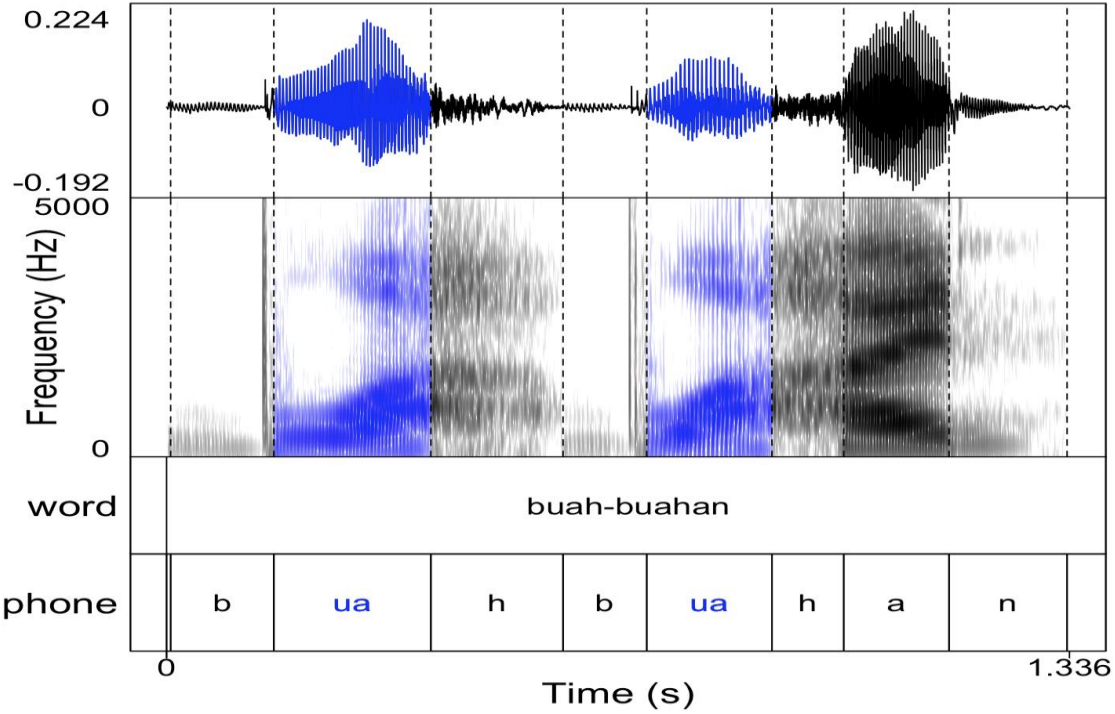
Fission

[bə.rw$_1$a$_2$ŋ]

Gliding

[CG_1.V_1a_2] vs. [CG_1a_2]

- Hard to diagnose in speech or through native speaker intuitions



/buah-buahan/ ‘fruits’

[buwah-buwahan]?

Musical text-setting as phonological evidence

- Musical adaptation of linguistic form can provide valuable insights into phonological structure and theory (see McPherson 2020 for a review).

Kawahara 2007; Katz 2015; Ng 2017; Starr & Shih 2017; McPherson & Ryan 2018; Hayes & Schuh 2019; McPherson 2019; Schellenberg & Gick 2020; Ladd & Kirby 2021; Ryan 2022; Zuraw & Roca 2025; Zuraw & Ahn 2025; Taniguchi 2026, *inter alia*.

- Pitch at the crossroads: Experimental approaches to the language-music connection (organized by Vincent Nwosu, Kathryn Franich, Darin Flynn)

Linking Hypothesis & Predictions

- Following Ng (2017), the number of musical pitches assigned to a word in singing reflects the number of syllables a speaker assigns in speech.

- Predictions:

1. Two vowels under fission (e.g., [CV_1.G_1a_2]) are more likely to map onto two distinct pitches rather than one.
2. Two vowels under fission are expected to be longer in duration than gliding (cf. Davidson & Erker 2014).

[CV_1.G_1a_2]	>	[CG_1a_2]
Fission		Gliding

Methods

Shila Amzah

- Nurshahila binti Amir Amzah (born in 1990)
- Singer-songwriter born and raised in Kuala Lumpur, Malaysia
- Active since 2000 (mostly pop)
- Two albums:
  - *Bebaskan* (2009): 10 songs
  - *Shila Amzah* (2013): 5 songs

Procedure

- For all the songs included in the corpus,

1. Extracted all morpheme-internal /Ci.a/ and /Cu.a/ sequences.
2. Excluded repeating lines.
3. Determined whether the sequences were assigned one or two distinct pitches by two independent transcribers (musician & phonetician).

Patah Seribu

Bila kan ku bisa menerima ketiadaanmu

Kan ku bakar semua hapuskan semua kenangan

ke-tiada-an-mu: one pitch

$semua_1$: two pitches

$semua_2$: one pitch

Procedure (cont.)

- For all the songs included in the corpus,

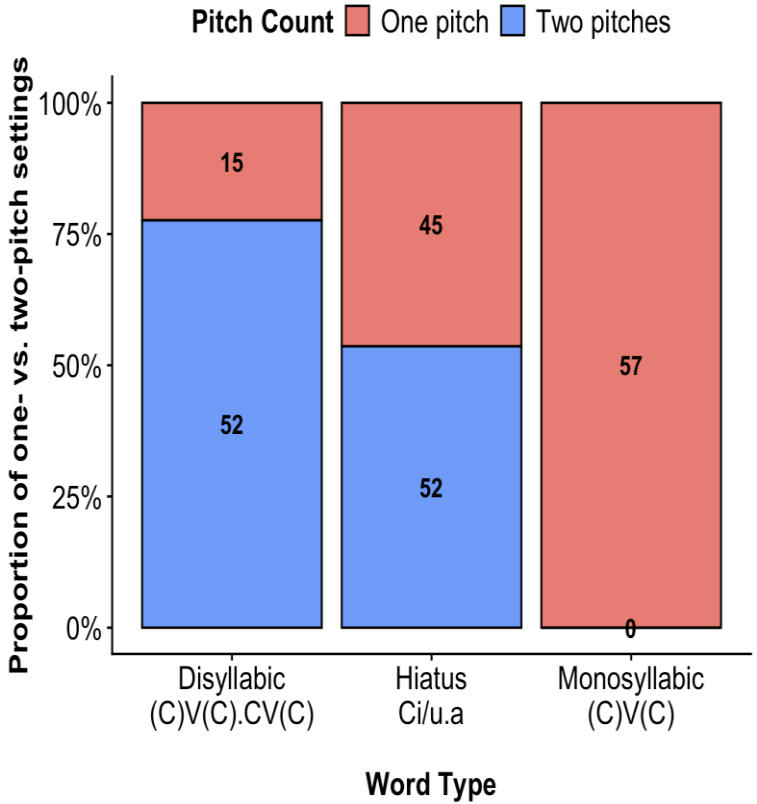
4. Measured the tempo of each song via beat onset estimation sampled at 48 kHz.
5. Normalized the tempo of each song to 120 BPM.
6. For each tempo-normalized song, the vocal stream was separated.
7. Measured the duration of /i.a/ and /u.a/ sequences in *Praat*. Sequences exhibiting extreme vibrato and melisma (> 1000 ms) were excluded.
8. Imported the dataset ($n = 97$) to *R* for further visualization and statistical analyses.

Results

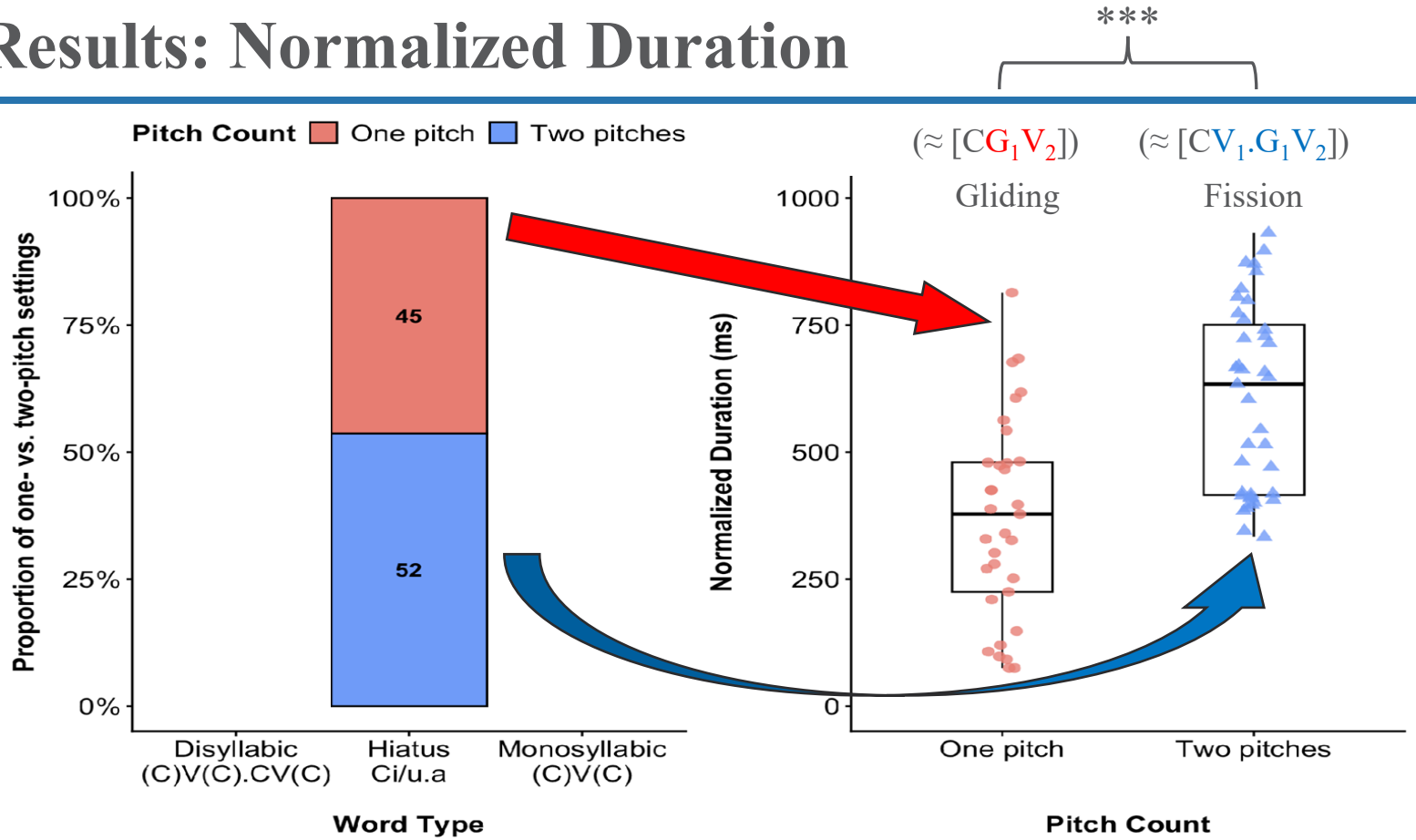
Results: Pitch Assignment

- Baseline:
  - ➢ Disyllables: *bila, tidak, gusar, sudah*, etc.
  - ➢ Monosyllables: *məŋ-, tər-, -kan, -mu*, etc.

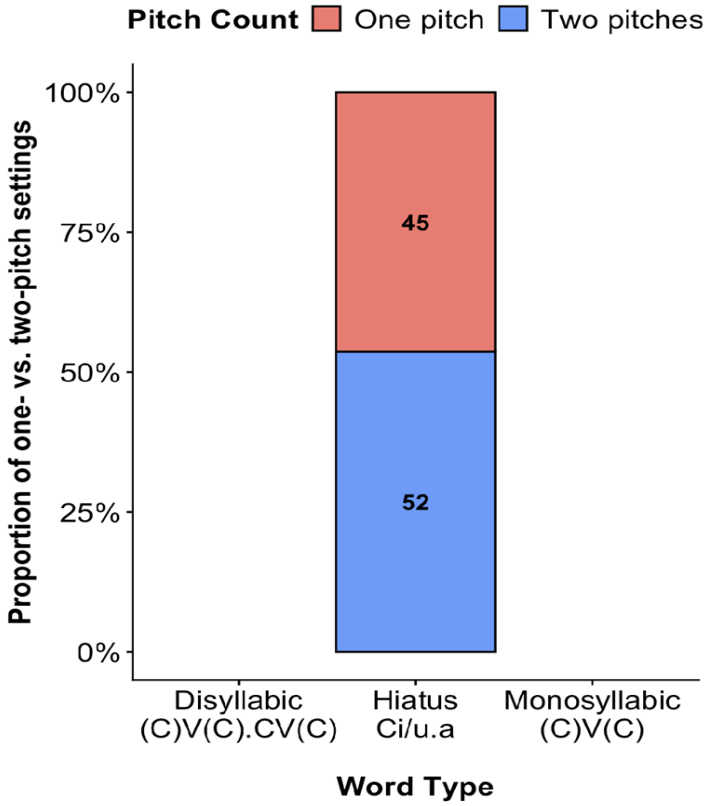
- Ci/u.a with hiatus:
  - ➢ One pitch: 46%
  - ➢ Two pitches: 54%

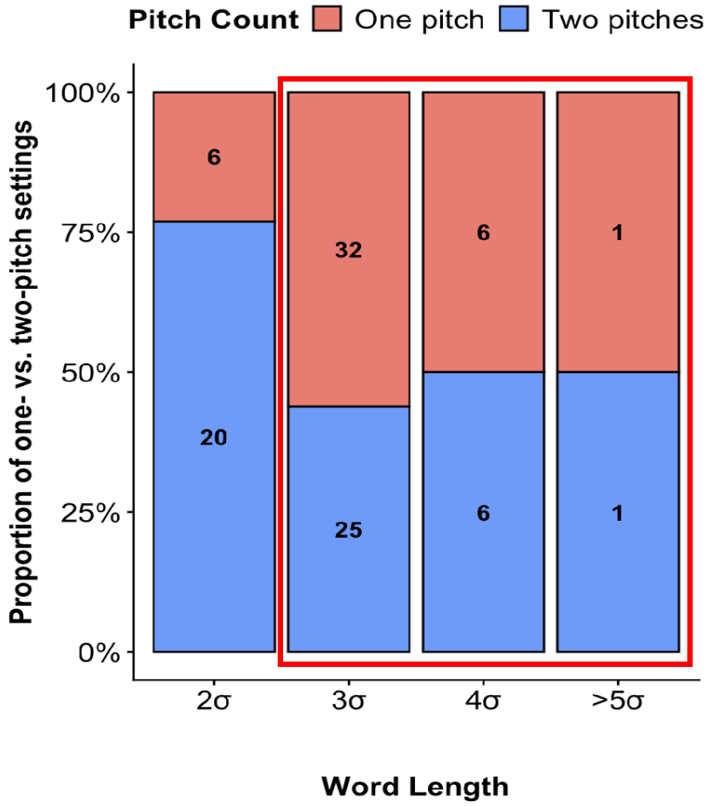


Results: Normalized Duration



Results: Word Length





Words longer than two σs permit more gliding [CGV].

Discussion

Discussion

- Traditional analyses of Malay syllable structure are overly categorical, since forms with complex onsets are attested.

➢ Influx of loanwords (Soh & Nomoto 2019: 478)

a. Loan words from Sanskrit
swasta 'private', *dwibahasa* 'bilingual', *prasangka* 'prejudice'

b. Loan words from English
drama 'drama', *klausa* 'clause', *krisis* 'crisis', *spek* 'spectacles', *stesen* 'station', *tradisi* 'tradition', *skrip* 'script', *struktur* 'structure'

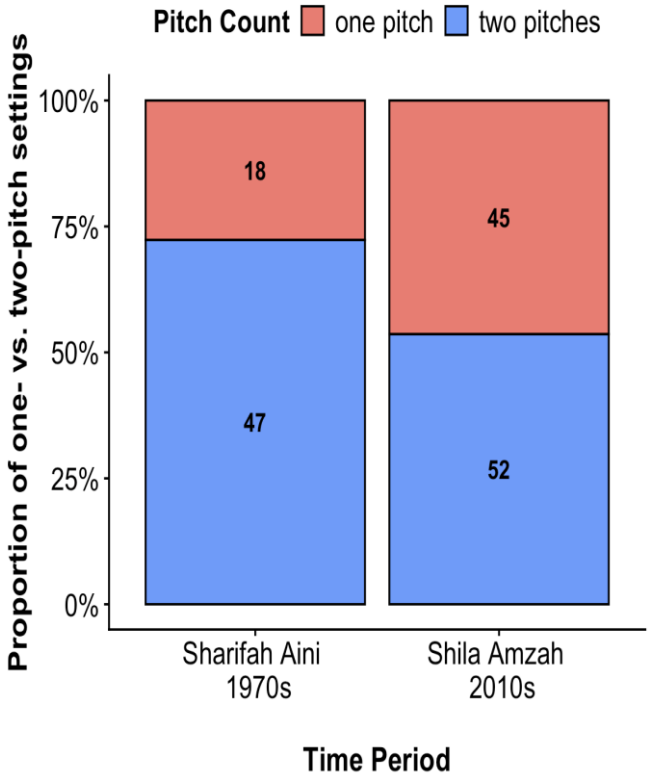
➢ Surface onset clusters due to optional schwa deletion (Clynes & Deterding 2011: 265)

- /tələh/ → [tə.lah]~[**tl**ah] 'already'
- /səgəra/ → [sə.gə.ra]~[sə.**gr**a] 'fast'

Conclusion & Future Directions

Conclusion & Future Directions

- The study demonstrates the practical use of musical text-setting to probe structural distinctions that are harder to diagnose in speech.
- A comparative study of Malay songs across different time periods – Has Malay become increasingly tolerant of onset clusters (cf. Starr & Shih 2017)?



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Appendix

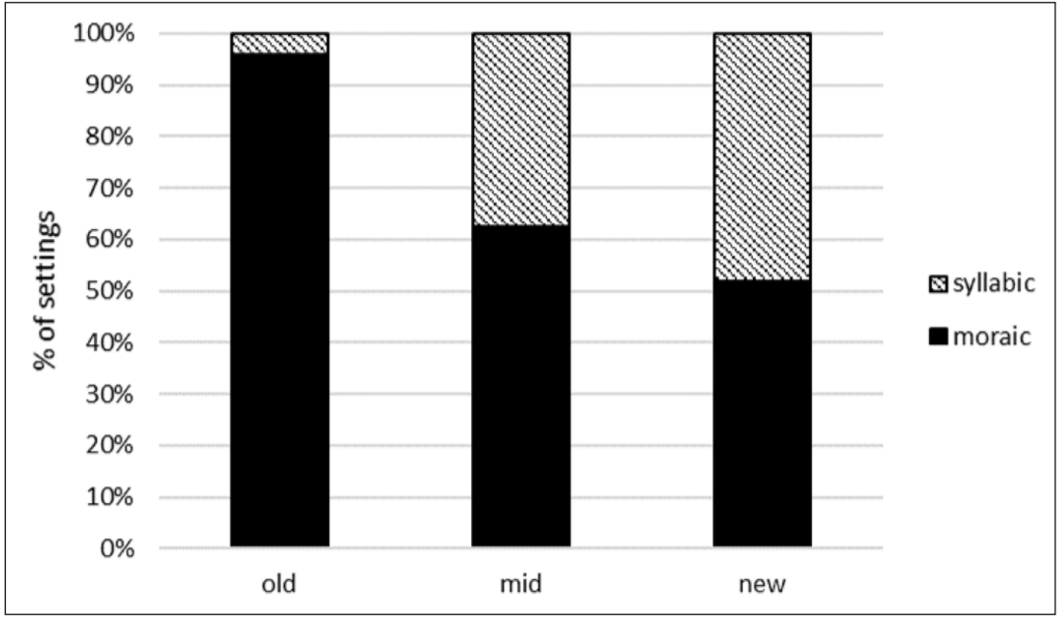
Starr & Shih (2017: 25)

- Figure 4: Proportion of moraic vs. syllabic settings for Christmas corpus songs by time period translated.

Old: Late 19th & Early 20th

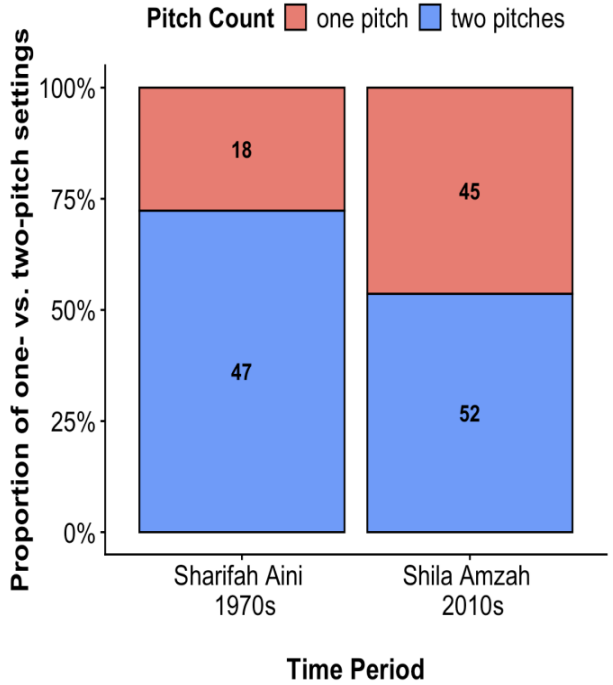
Mid: Mid-20th

Late: Late 20th and Early 21st

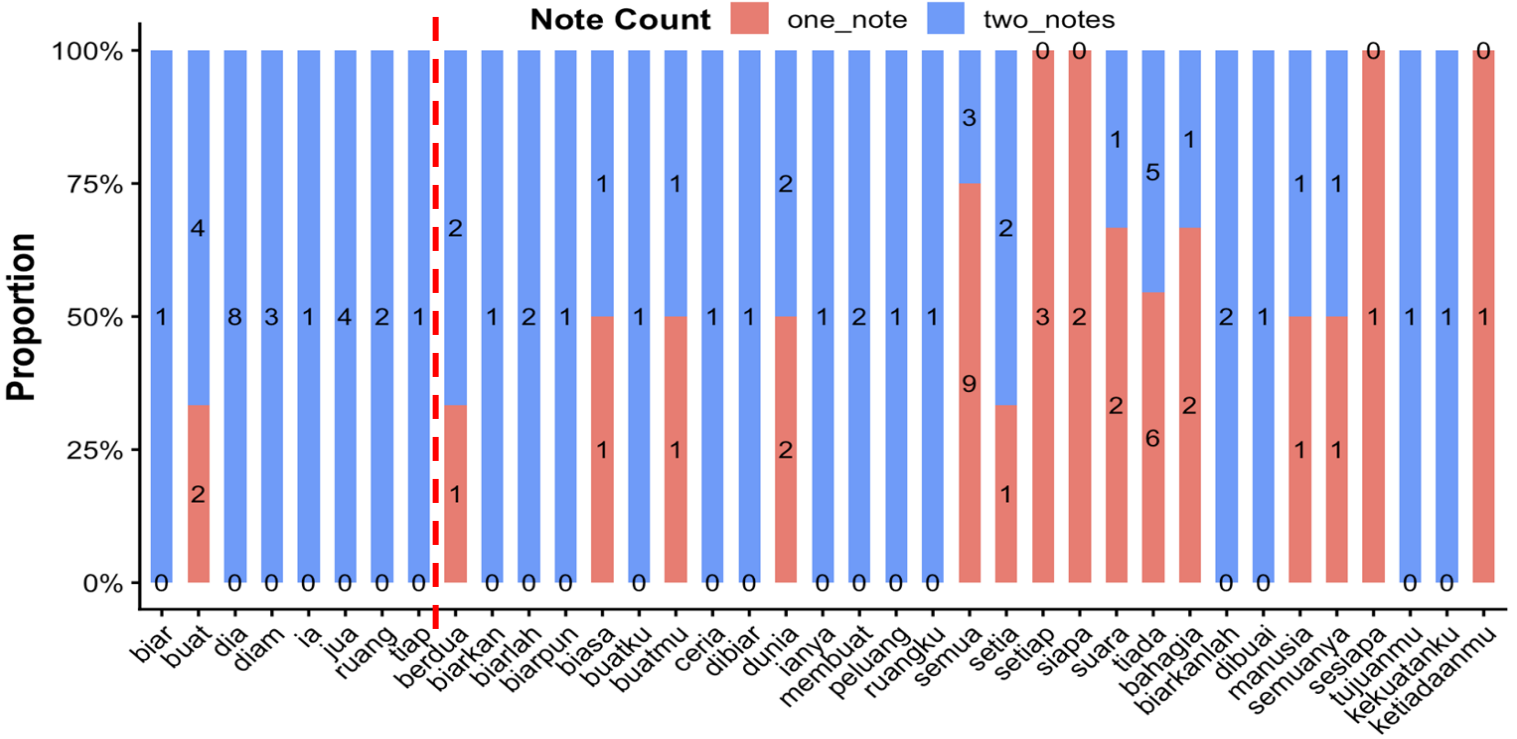


Sharifah Aini

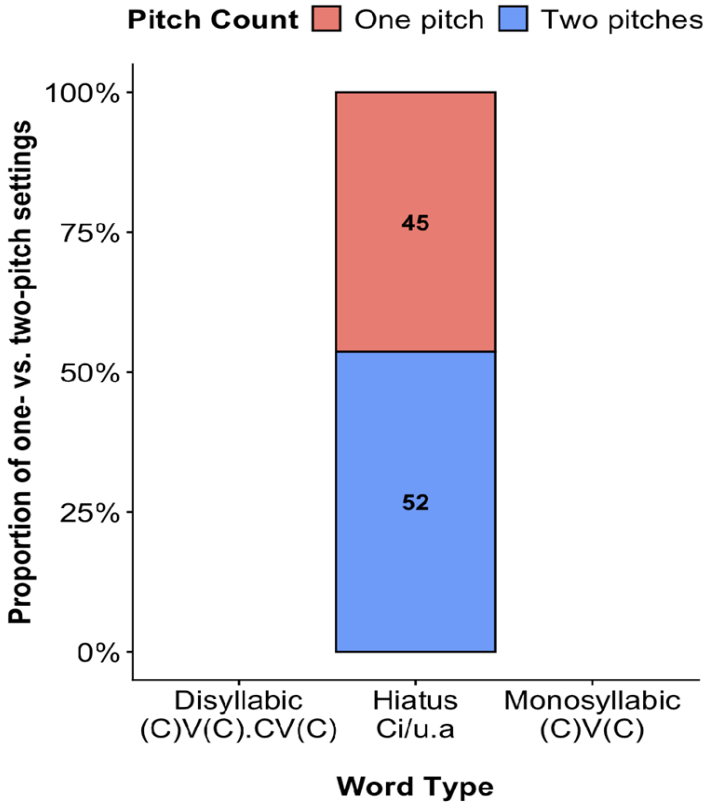
- Sharifah Aini binti Syed Jaafar (2 July 1953 – 5 July 2014)
- Born in Johor Bahru, Malaysia
- Years active: 1968–2014
- Corpus: 15 songs from the 1970s

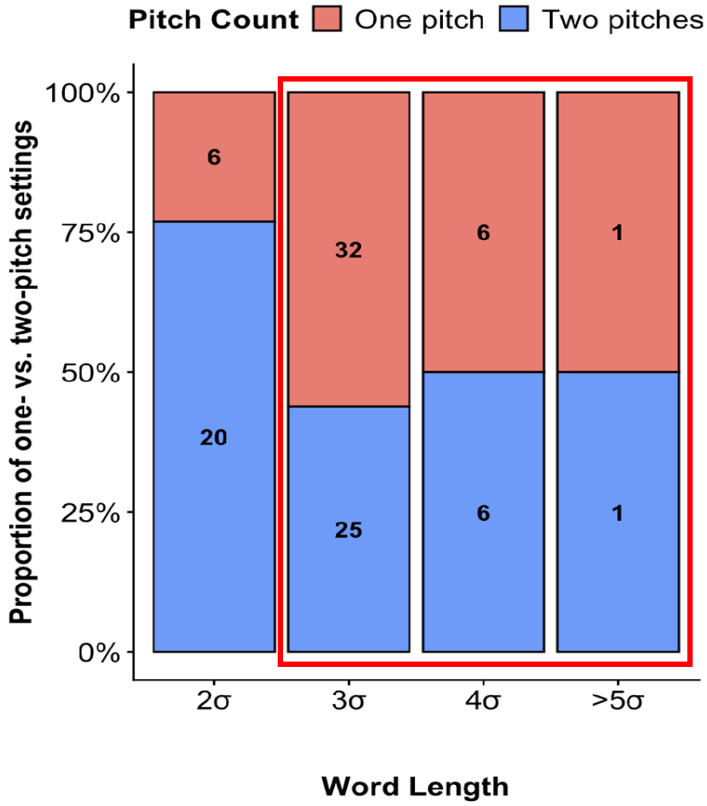


Results: Individual Words



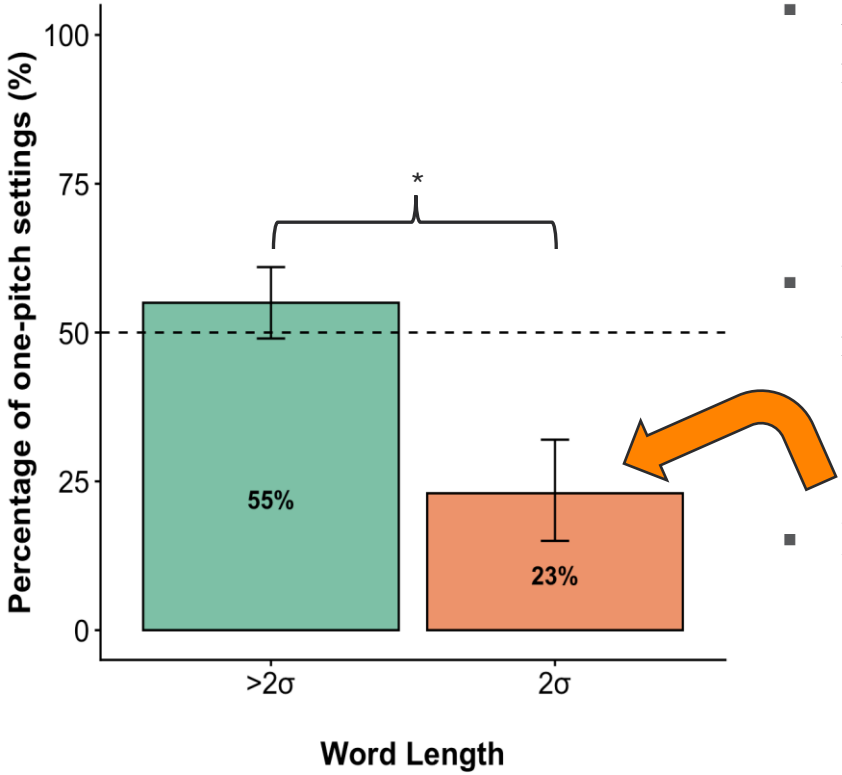
Results: Word Length





Words longer than two σs permit more gliding [CGV].

Prosodic Minimality Effect + Frequency Matching



- A generalized mixed-effects logistic regression model confirmed this observation.
- Words with two syllables had a lower rate of gliding compared to words longer than two syllables (the baseline).
- More than 90% of native roots in Malay lexicon are disyllabic (Adelaar 1992).

Malay Inventory

- Consonant inventory: /p b t d tʃ dʒ k g s h m n ɲ ŋ r l (j) (w)/
- Vowel inventory: /i u e o a ə/

	Labial	Alveolar	Post-alveolar*	Palatal	Velar	Glottal	Labial-velar
Plosive/Affricate	p b	t d	tʃ dʒ		k g	(ʔ)	
Fricative	(f) (v)	s (z)	(ʃ)		(x)	h	
Nasal	m	n	ɲ		ŋ		
Trill		r					
Approximant				j			w
Lateral		l					

(Clynes & Deterding 2011; Nomoto & Soh 2019)

Traditional analysis of hiatus resolution

Given an input /bəru$_1$a$_2$ŋ/ ‘bear’, the hiatus is resolved via fission, e.g., [bə.ru$_1$.w$_1$a$_2$ŋ].

	INPUT: /bəru$_1$a$_2$ŋ/		ONSET	CODACOND	*COMPLEX	DEP-IO	INTEGRITY-IO	IDENT-IO[SYL]
	a.	bə.ru$_1$.a$_2$ŋ	*!					
	b.	bər.w$_1$a$_2$ŋ		*!				*
Gliding	c.	bə.rw$_1$a$_2$ŋ			*!			*
	d.	bə.ru$_1$.ʔa$_2$ŋ				*!		
Fission	e. ☞	bə.ru$_1$.w$_1$a$_2$ŋ					*	

Ahmad (2005:32)

Ahmad (2005): post-vocalic high vowels

- Constraint-based analysis couched in Optimality Theory (Prince & Smolensky 1993)
- Given an input /pulau/ ‘island’:

INPUT: /pulau/		ONSET	*COMPLEX	DEP-IO	INTEGRITY-IO	IDENT-IO[SYL]
a.	pu.la.u	*				
b.	pu.la.wu				*	
c.	pu.la.ʔu			*		
d. ☞	pu.law					*

- Vowels: [+syllabic]; glides : [−syllabic]

Coding (cont.)

- Some more information above the “Boundary” column:
  - Internal: dun**ia**
  - Prefixation: d**i-a**da-kan
  - Suffixation: ke-abad**i-a**n
  - Word: d**i**#**a**tas
  - Phrase: …….. in**i**

    Ada ……

Discussion

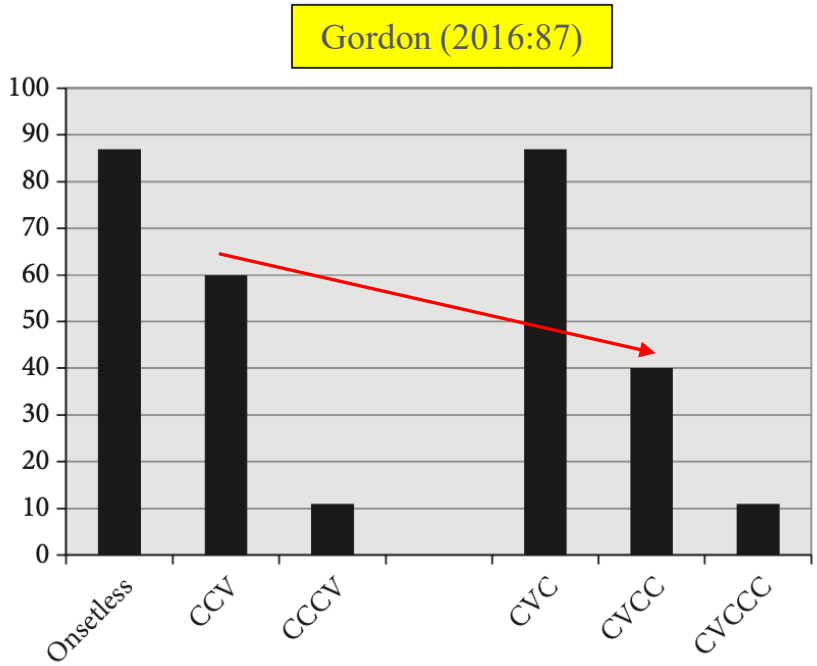
- Why are coda clusters VCC categorically avoided but onset clusters CCV can optionally surface?

➢ Relative typological markedness

VCC >> CCV >> CV

Data from WALS 100-language sample

(World Atlas of Language Structures)



Terima kasih!

Output of the *Solver* function in Excel

Constraint	Weight
ONSET	20.66
PROSODIC MIN	2.40
*ONSETCC	0.0015
*CODACC	8.32
INTEGRITY-IO	0.039
IDENT-IO-[SYLLABIC]	0.123

Predicted vs. Observed Probabilities