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Lexical Stress and Syllable Weight in Hindi-Urdu Pop Text-Setting

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Lexical stress in Hindi-Urdu

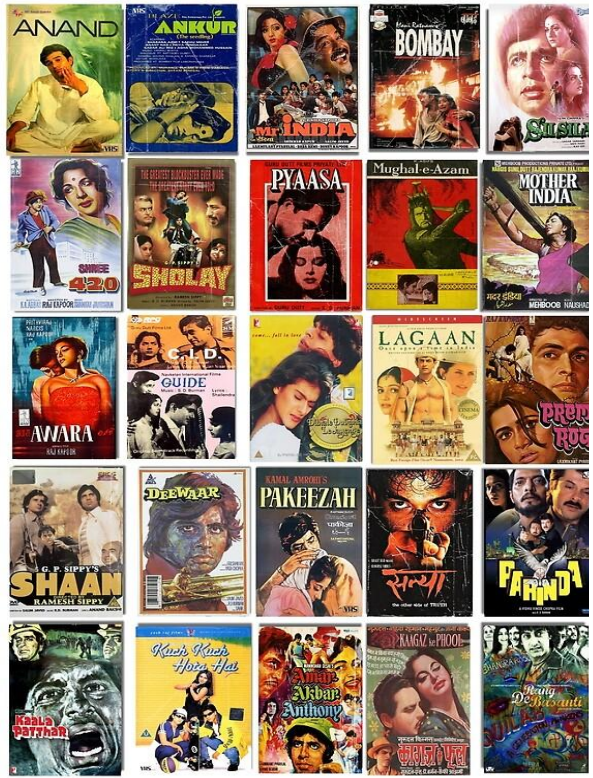
Author	Lexical stress?
Féry (2010)	No
Harnsberger (1996)	No
M. Ohala (1999, 1994, 1991, 1977)	No
Mehrotra (1965)	Yes
Pandey (1989, 2021)	Yes
Hussain (1997)	Yes
Nair (1998, 1999)	Yes
Mumtaz, Bögel, Butt (2020)	Yes

Problems with earlier studies

- Extremely low sample sizes
- Elicitation of data in (preverbal) focus position
- Lack of controls for L1/L2 background

A new data source: Bollywood pop music

- Pop music and natural speech rhythm
- Text-setting in pop music to investigate lexical stress (Nichols et al. 2009, Zuraw and Roca 2025, Zuraw and Ahn forthcoming)
- Rich tradition of pop music in Hindi-Urdu



Text-setting as a window into phonology

- How to set lyrics to music?
- Native speaker text-setting intuitions based on phonological grammars (e.g., Allen 1973:13, Hayes 2009, Rodríguez-Vázquez 2010, Kiparsky 2020, Temperley 2022, Moreno and Bariş 2022).

Text-setting

Correspondence between linguistic structures and music (cf. Dell & Halle 2009, Proto 2013, Temperley and Temperley 2013, McPherson 2020, Ryan 2022):

- Tone
- Duration
- Prominence
- Constituency

Focus of this study

- **Duration matching**: Aligning heavier syllables with longer beats
- **Prominence matching**: Aligning stressed syllables with musically prominent events (on-beats)

Text-setting in Hindi/Urdu

Fairbanks 1981, 1987a, 1987b:

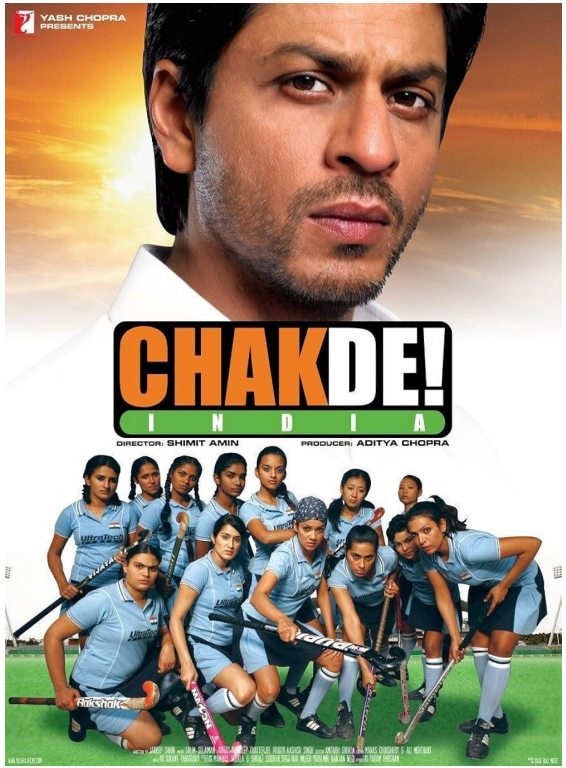
- Putatively stressed syllables more likely be to set to more prominent metrical positions of the verse lines.

- Problems:
  - Preponderance of archaic Sanskritized vocabulary
  - Composed in older Medieval-period meters

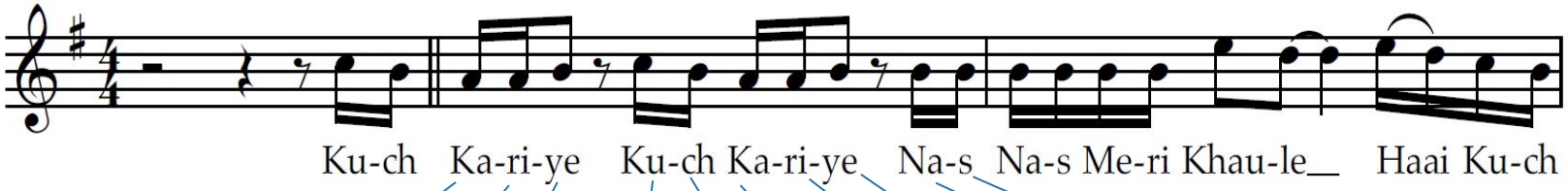
Data

Songs list

Choli Ke Peeche	Deewangi Deewangi
Ishq Jaisa Kuch	Jaane Kyun
Heeriye	Nagada Sang Dhol
Tere Naina	Zindagi Ek Safar
Uska Hi Banana	Saare Jahan
Senorita	Chak De India
Awara Hoon	Kabira
Meri Laila	Raataan Lambiyaan



Converting sheet music to spreadsheets

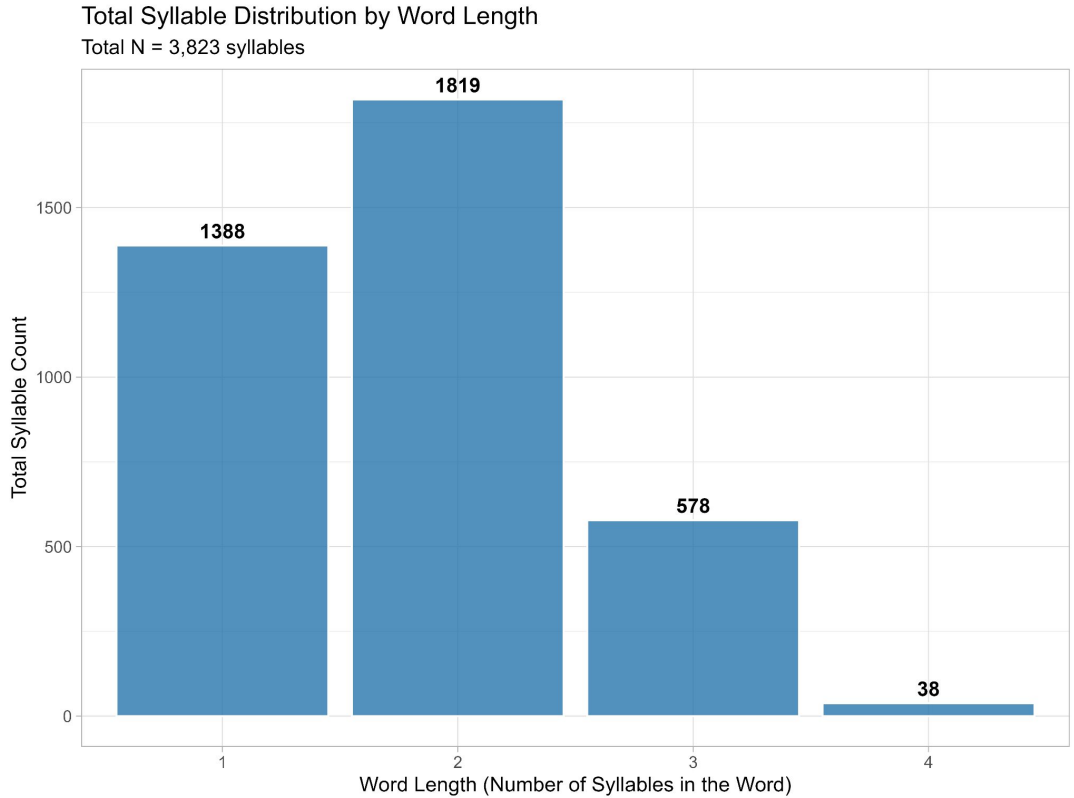


beat		1	1.25	1.5	1.75	2	2.25	2.5	2.75	3	3.25	3.5	3.75	4	4.25	4.5	4.75
whole																	
half																	
quarter																	
eighth																	
sixteenth																	
text		ka	-	ri	ye		ku	-	chh@	ka	-	ri	ye		na	s@	
stress																	
length																	
syll_position		1		2	3		1			1		2	3		1	2	
measure		2		2	2		2			2		2	2		2	2	
line_number																	
repeat																	
notes																	
phrase_pos		0		0	1		0		0	0		0	1		0	0	
ons		k		r	y		k		ch	k		r	y		n	s	
nuc		a		i	e		u		@	a		i	e		a	@	
coda		0		0	0		0		0	0		0	0		0	0	
n_syll_sung		3					2			3							
n_syll_sp		3					1			3							
word_type		content			content					content					content		

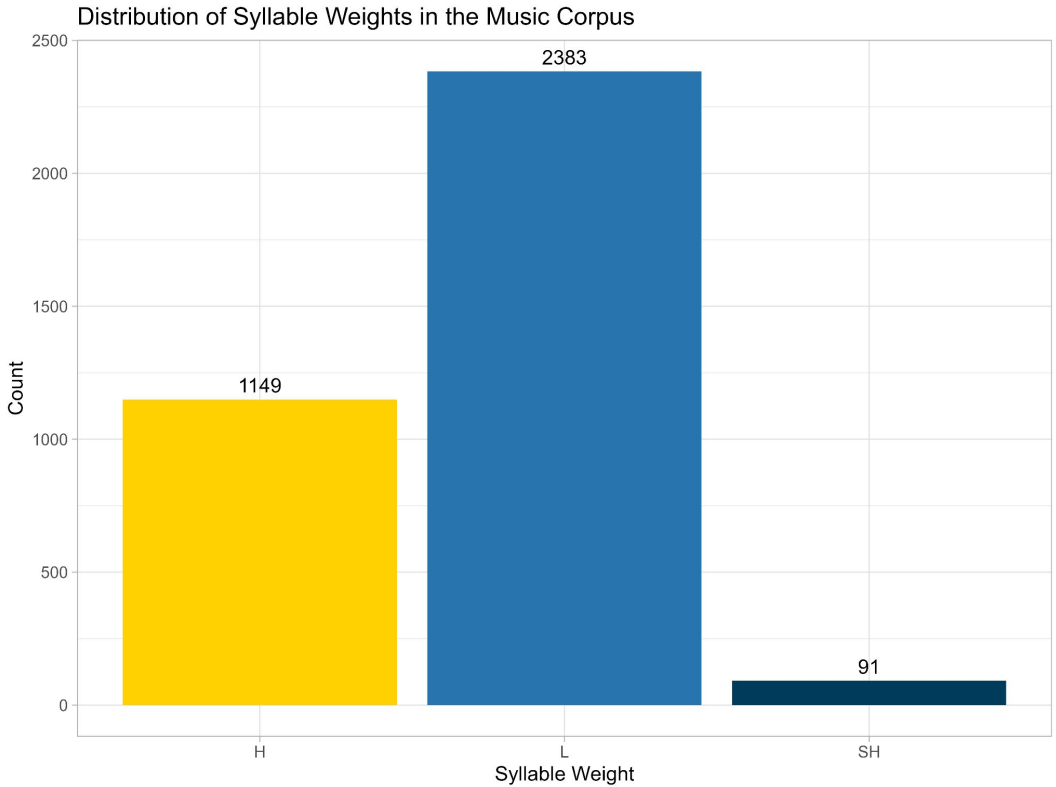
Data Exclusion

- Melismatic settings
- Syllables set to longer than four beats
- Onomatopoeic words
- Syncopated beats

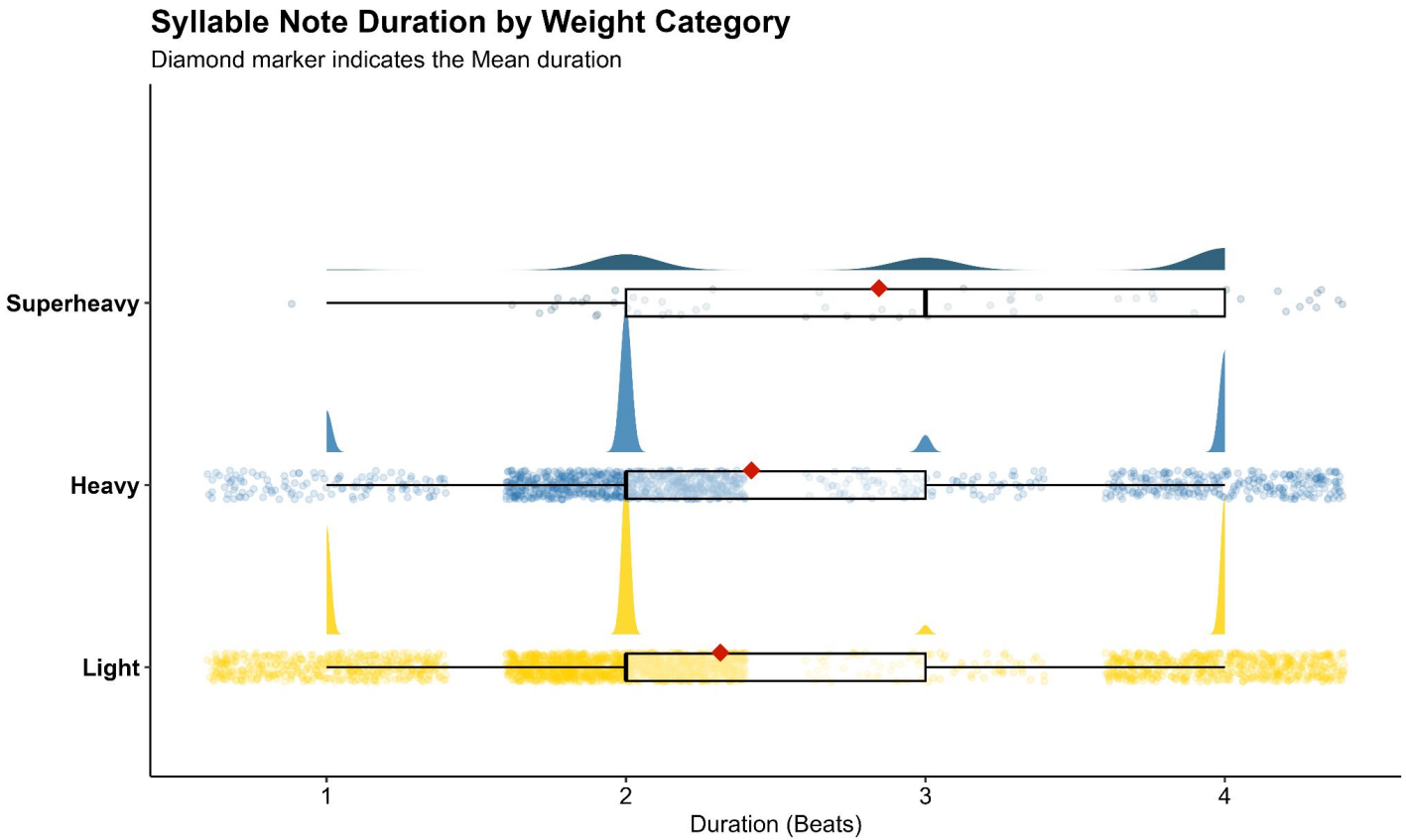
Word sizes at a glance



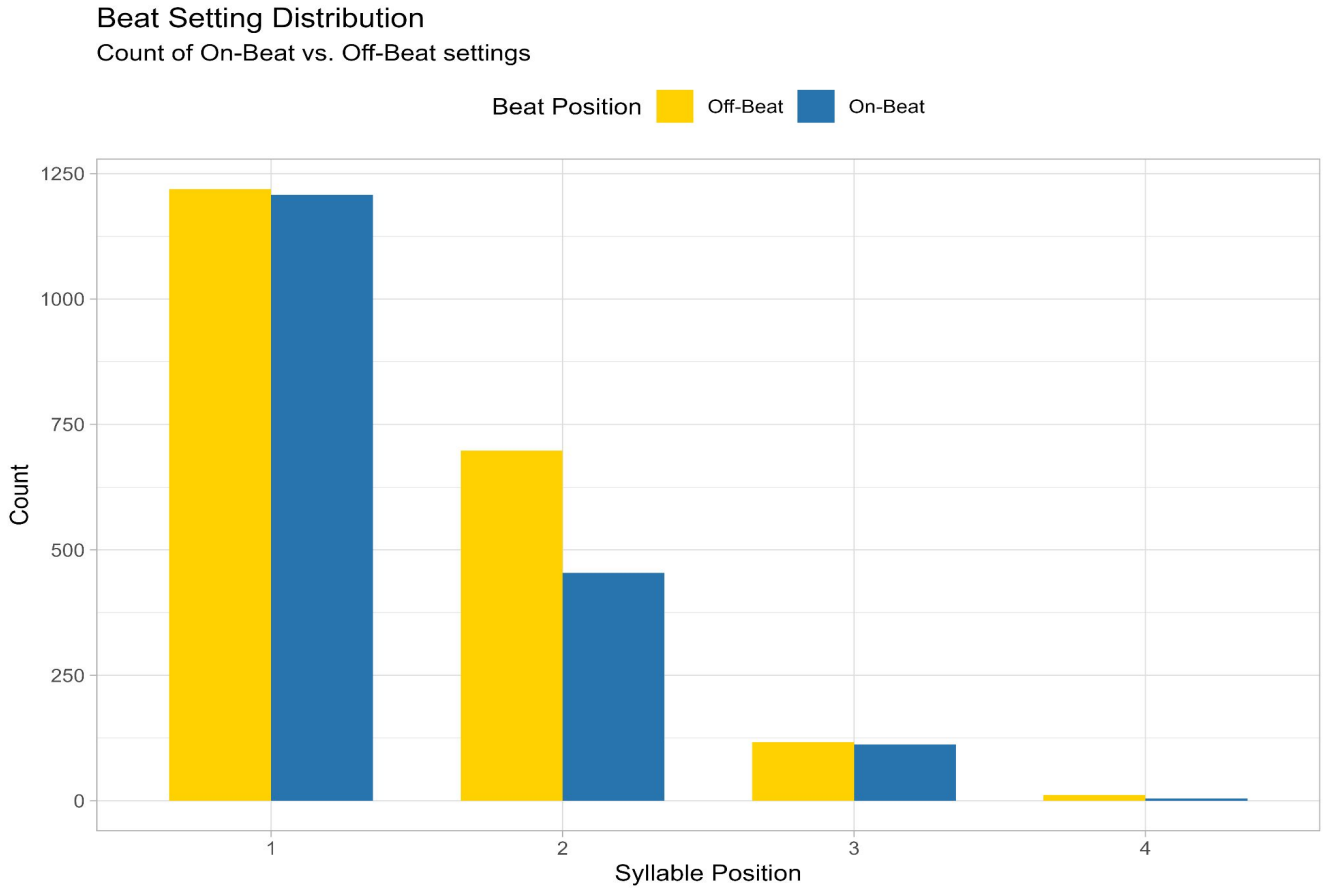
Syllable weight at a glance



Distribution of syllabic beat durations



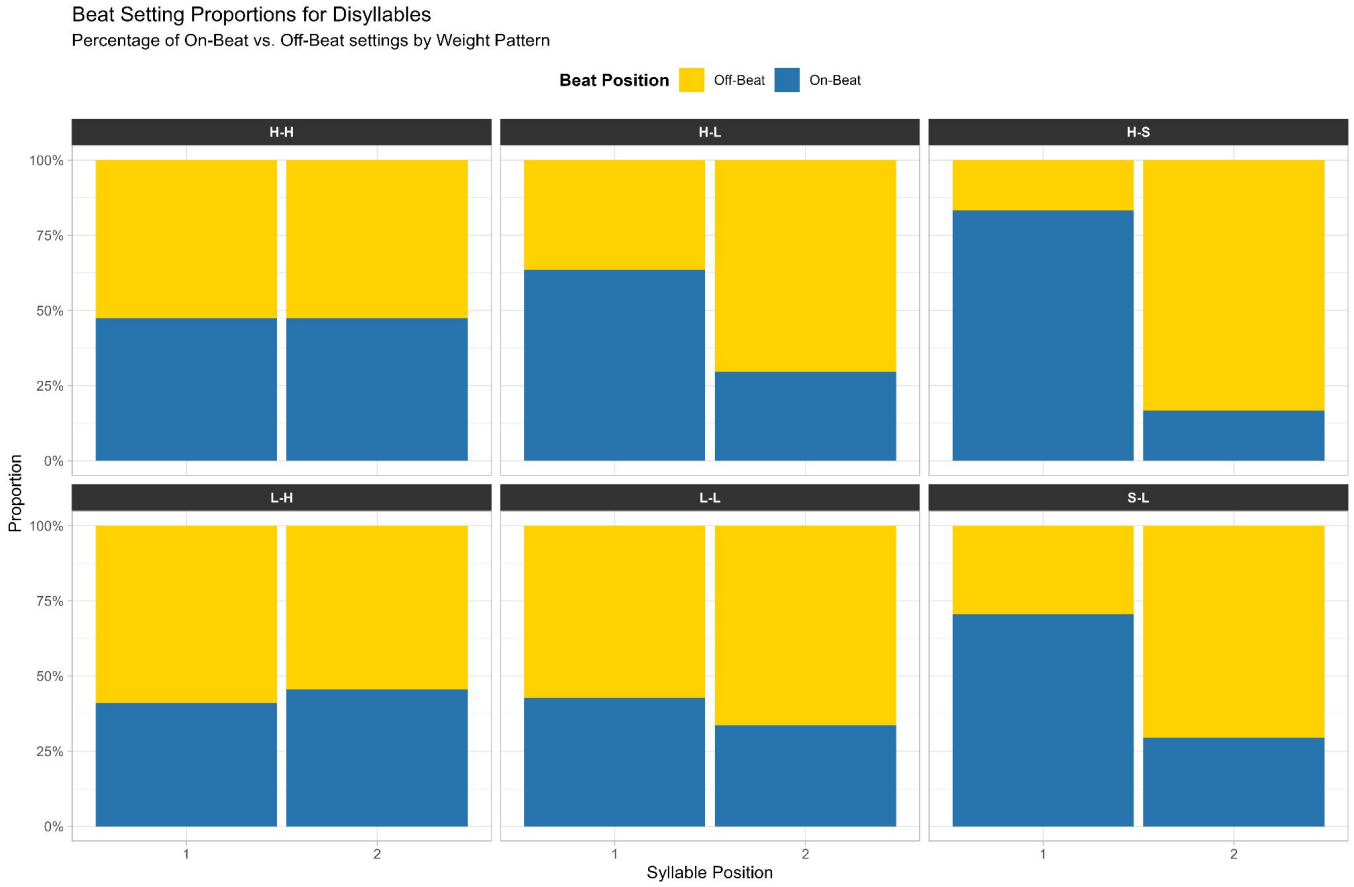
Distribution of syllabic beat alignment



Claims about the distribution of stress in disyllabic words

Word Type	Stress Pattern (e.g., Pandey 1989, 2021; Hayes 1995)
LL	ˈLH
HL	ˈHL
LH	LˈH
LS (S = superheavy)	LˈS
SL	ˈSL
SH	ˈSH

Distribution of beat alignment for disyllables



Methods and results

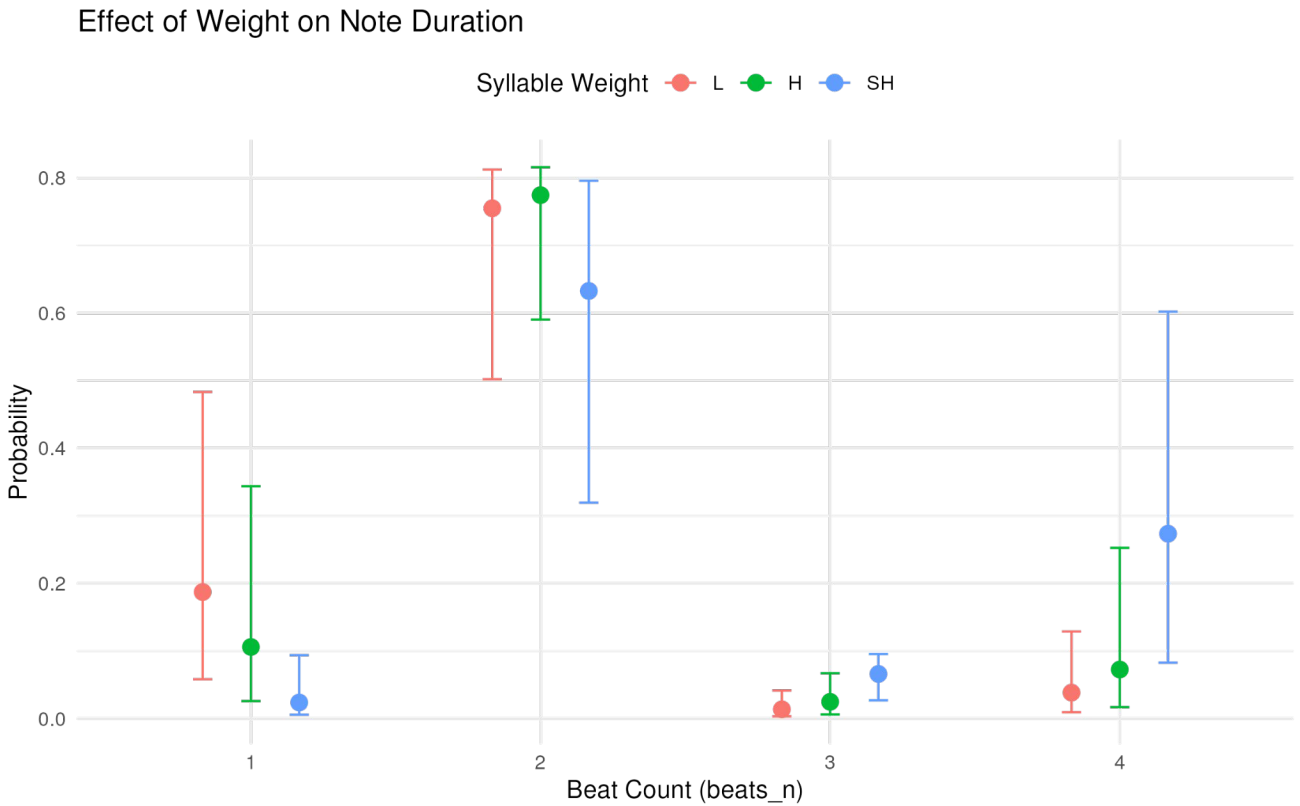
Hypotheses to test

- Are putatively stressed syllables more likely to be set to on-beats?
- Are putatively stressed syllables set to longer beat intervals compared to their unstressed counterparts?
- How we are coding for “putative stress”?
    - Agreement on the stress of bisyllabic words and disagreement on almost everything else.
    - Test for only bisyllabic words here

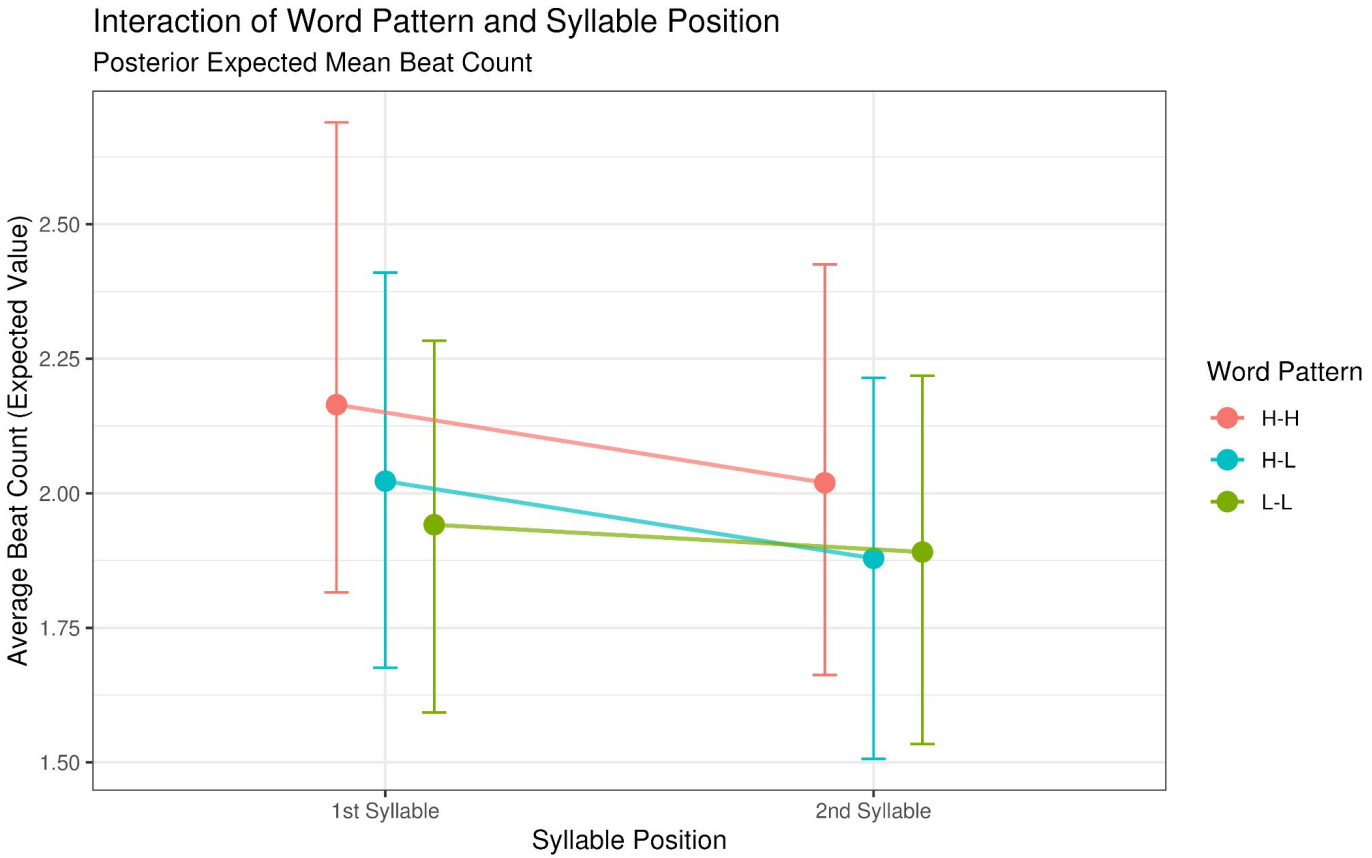
Logistic regression for syllable beat settings

- Log-odds of on-beats setting given some predictors
- log ((p = on-beats) / 1 - (p = on-beats))
- Dependent variable:
  - on-beats or off-beat? (1/0)
- Predictor variables:
  - Syllable weight (Fixed effect)
  - Syllable position (Fixed Effect)
  - Word Length (Fixed effect)
  - Phrase-finality (Fixed effect)
  - Word (Varying effect)
  - Song (Varying effect)

Effect of syllable weight on note duration of disyllabic words



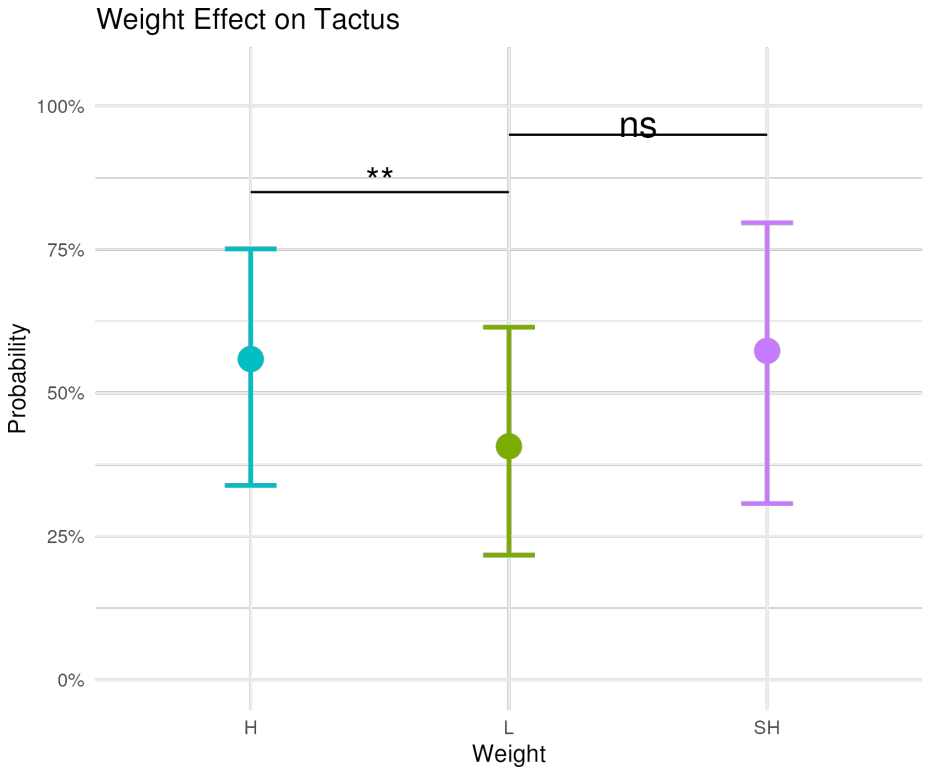
Effect of putatively stressed syllables on note duration



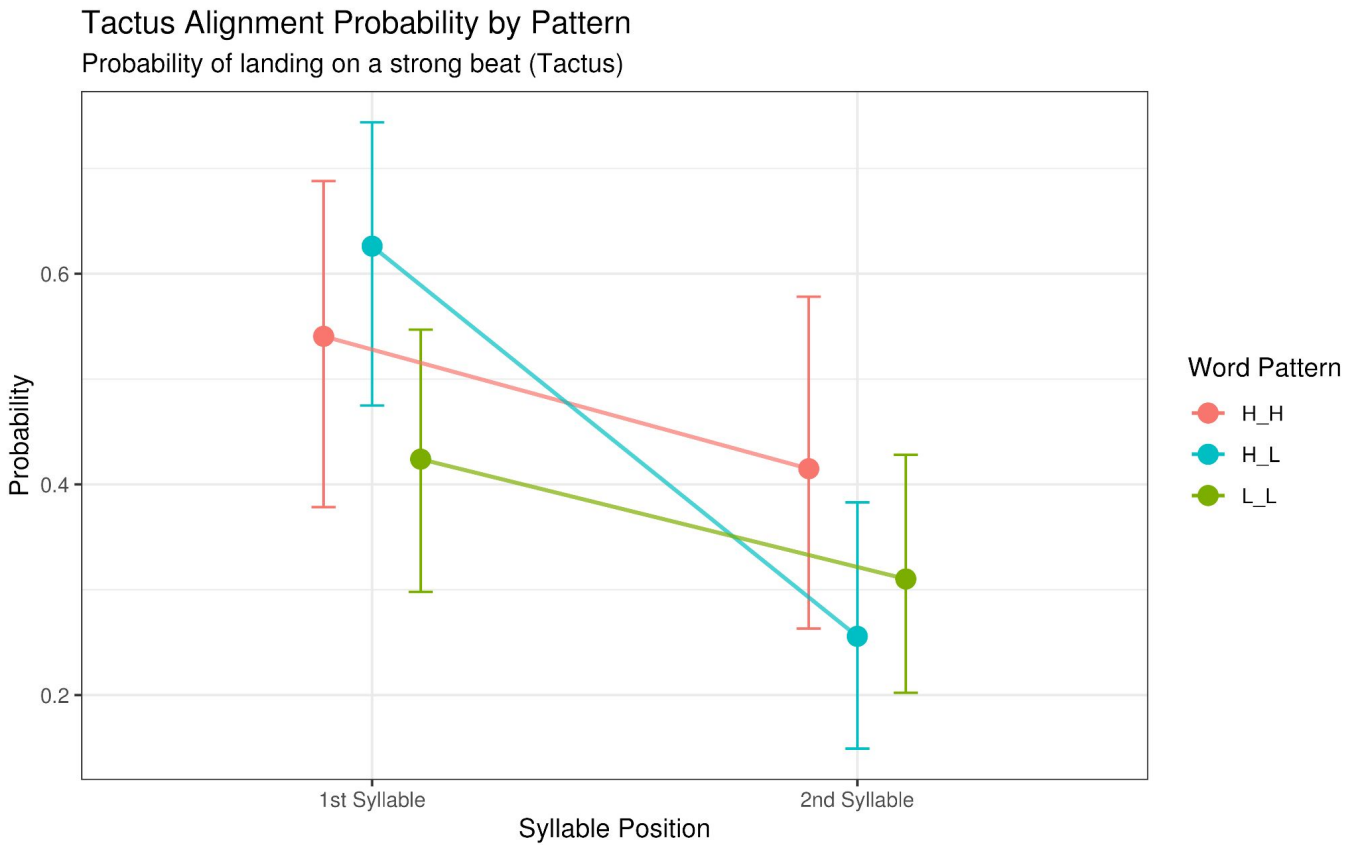
Ordered logistic regression for note durations

- More than two categories of the dependent variable (1–4 notes)
- Sequential order (4 notes > 3 notes > 2 notes > 1 note)
- True scale unknown (how longer are 4 notes than 3 notes?)
- Dependent variable:
  - Total notes a syllable is set to
- Predictor variables:
  - Syllable weight (Fixed effect)
  - Word Length (Fixed effect)
  - Phrase-finality (Fixed effect)
  - Word (Varying effect)
  - Song (Varying effect)

Effect of syllable duration on beat alignment



Effect of putatively stressed syllables on beat alignment



Conclusions

- Effects of duration matching does not seem to be present in Hindi-Urdu pop text-settings.
    - Syllable alignment: (Super)Heavy syllables alleged to be stressed are not set to longer beats.
- Very weak evidence for lexical stress: Hindi-Urdu pop music reveals that putatively stressed syllables are more likely to be aligned to on-beats.
- In text-setting, stress is encoded only in beat alignment and not note duration in Hindi-Urdu pop music (cf. Zuraw and Ahn forthcoming for Korean).

Future directions

- Extend the corpus and include rap music
- Code for melodic peaks to investigate lexical stress and its relationship with pitch movements in music.
- Incorporate acoustic evidence from experiments
- Perform a meta-analysis of experimental data

Thank You

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References

Bobaljik, Jonathan David, David Koester, Chikako Ono & Georgi Dmitrievich Zaporotskij. 2023. Text setting in an Itelmen khodila: A phonological analysis. *Language*. Linguistic Society of America 99(2). e108–e134.

Dell, Francois & John Halle. 2009. Comparing musical textsetting in French and in English songs. In Andy Arleo & Jean-Louis Aroui (eds.), *Towards a Typology of Poetic Forms*, 63–78. John Benjamins. https://www.jbe-platform.com/content/books/9789027289049-lfab.2.03del. (21 May, 2021).

Hayes, Bruce. 2009. Faithfulness and componentiality in metrics. In Sharon Inkelas & Kristin Hanson (eds.), *The nature of the word*, 113–148. Cambridge, MA: MIT Press.

McPherson Laura. Musical adaptation as phonological evidence: Case studies from textsetting, rhyme, and musical surrogates. *Language and Linguistics Compass*. 2019; 13:e12359. https://doi.org/10.1111/lnc3.1235

Moreno, Christina Domene and Kabak, Barış. "Prominence alignment in English and Turkish songs: Implications for word prosodic typology". *How Language Speaks to Music: Prosody from a Cross-domain Perspective*, edited by Mathias Scharinger and Richard Wiese, Berlin, Boston: De Gruyter, 2022, pp. 223-258. https://doi.org/10.1515/9783110770186-009

References

Nichols, Eric & Morris, Dan & Basu, Sumit & Raphael, Christopher. (2009). Relationships Between Lyrics and Melody in Popular Music.. 471-476.

Proto, Teresa. 2013. Singing in German: text-setting rules and language rhythm. In Galatà Vincenzo (ed.), *Multimodalità e multilingualità: la sfida più avanzata della comunicazione orale*, 9–10. Rome: Bulzoni.

Proto, Teresa & François Dell. 2013. The structure of metrical patterns in tunes and in literary verse. Evidence from discrepancies between musical and linguistic rhythm in Italian songs. *Probus: International Journal of Latin and Romance Linguistics* 25(1). 105–138. https://doi.org/10.1515/probus-2013-0004.

Rodríguez-Vázquez, R. (2010). Text-setting Constraints: A Comparative Perspective. *Australian Journal of Linguistics*, *30*(1), 19–34. https://doi.org/10.1080/07268600903134004

Temperley, David. "Music and Language." *Annual Review of Linguistics* 8 (2022): 153–70. https://doi.org/10.1146/annurev-linguistics-031220-121126.

References

Temperley, Nicholas & David Temperley. 2013. Stress-meter alignment in French vocal music. *The Journal of the Acoustical Society of America* 134(1). 520–527. https://doi.org/10.1121/1.4807566.

Zuraw, Kie & Paolo Roca. 2025. Evidence for stress in Filipino text-setting. *Phonology*.