Prominence-boundary interactions in speech perception: evidence from Japanese vowel length

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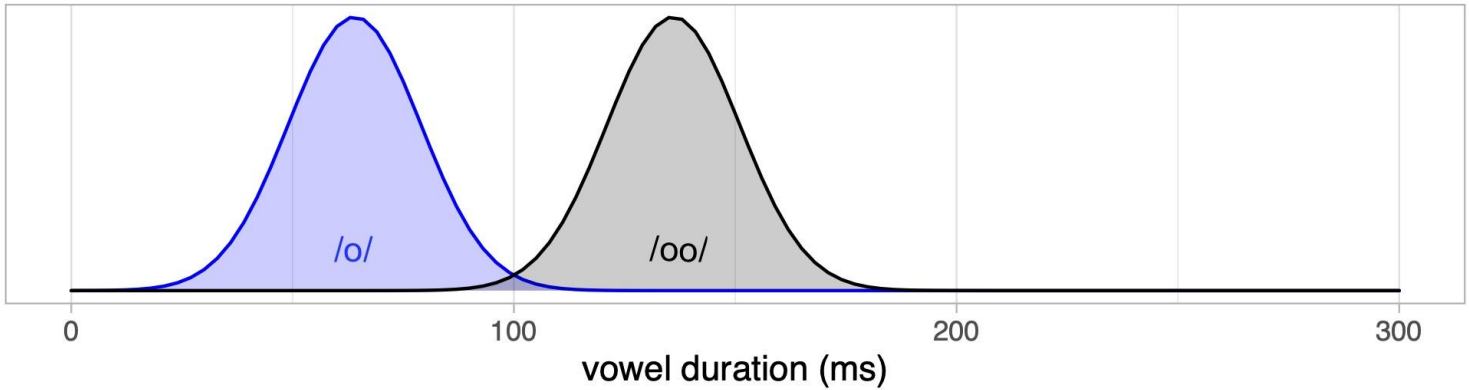
Background

- Phrasing influences distribution of durational cues
  - Vowels longer phrase-finally due to final lengthening (e.g., Vaissière, 1983)
- In Japanese, this creates overlap distribution of contrastive vowel length categories (Shepherd, 2008)



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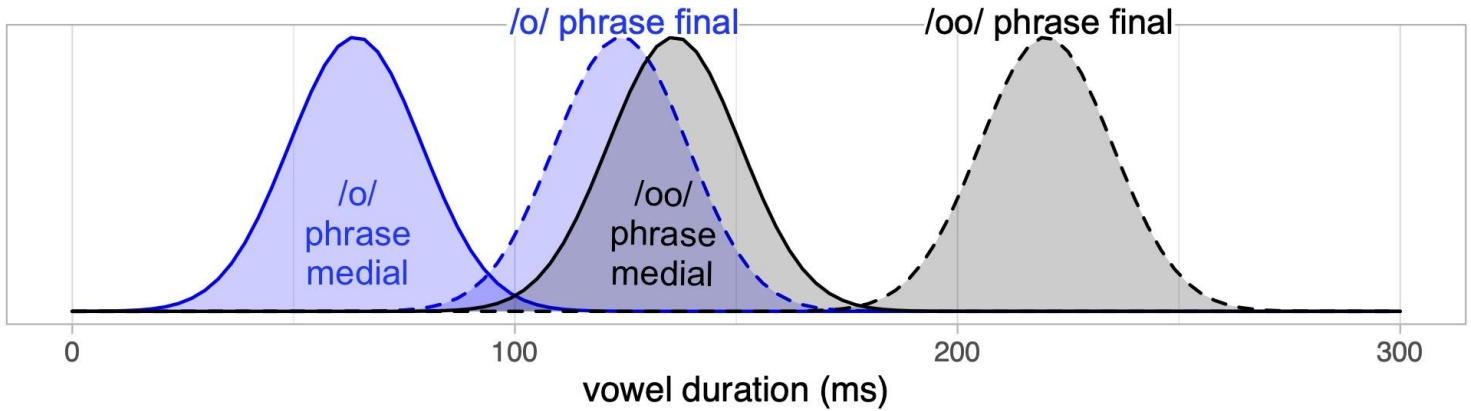
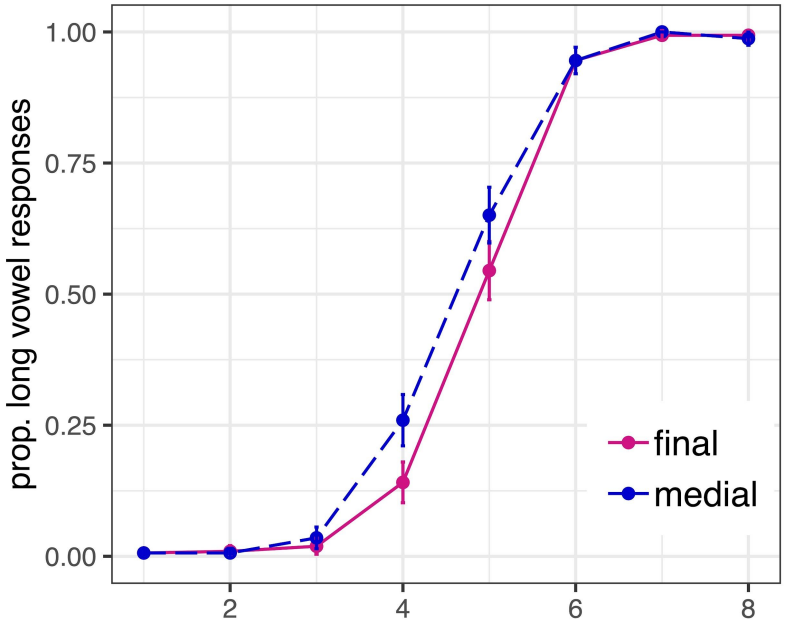


Background: Steffman & Katsuda (2021)

- Listeners used phrasing information to guide their perception of contrast
- The perceptual boundary shifted to higher values in final position

  → a phrase final vowel must be longer in duration to be perceived as phonemically long.



Background: prominence-boundary interactions

- BUT boundary phenomena also interact with prominence effects (e.g., Kohler, 1983 for German; Cambier-Langeveld 2000 for Dutch; Turk & Shattuck-Hufnagel, 2007 for English)

- E.g., In English, the rime of the non-final main stress syllable (e.g., *Mádison*) in the sentence-final word is lengthened (Turk & Shattuck-Hufnagel, 2007)

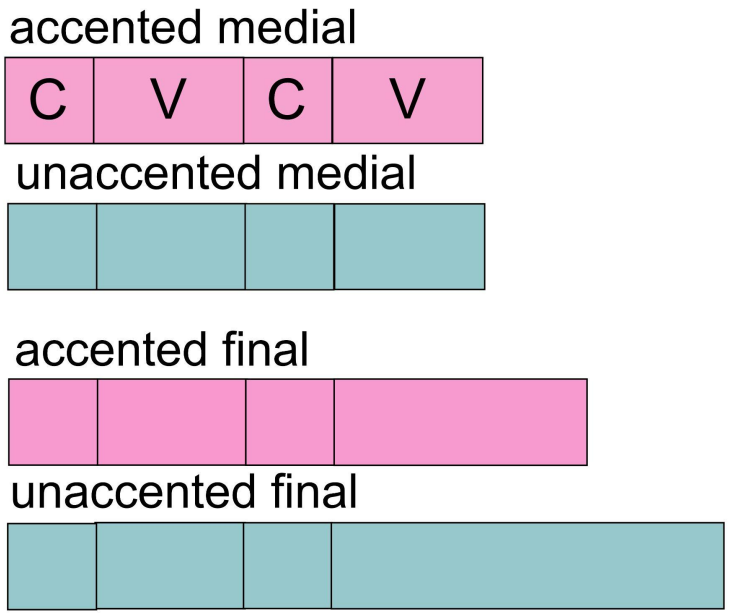
- Preservation of duration prominence of the main stress syllable, in the context of final lengthening

Background: prominence-boundary interactions

- Japanese has lexical pitch accent
  - e.g., *áme* “rain” vs. *ame* “candy”
  - Realized as a pitch fall without changing duration

- Unaccented disyllabic words exhibit greater final lengthening than disyllabic words with the initial pitch accent (e.g., *taka* exhibits more final lengthening *táka*) (Seo et al., 2019)

- Preservation of prominence of the accented syllable, by suppression of final lengthening



The present study

- Does perception of durational cues reflect this prominence-boundary interaction?

Experimental design

- 2AFC identification task (N = 38); duration continuum (/u/~/uu/): 35-125ms

	IP-medial	IP-final	translations
Accented	[… ***jísyu~uu*** …]$_{IP}$	[… ***jísyu~uu***]$_{IP}$ [...]$_{IP}$	***jísyu*** “voluntary” 自主 ***jísyuu*** “next week” 次週
Unaccented	[… ***jisyu~uu*** …]$_{IP}$	[... ***jisyu~uu***]$_{IP}$ [...]$_{IP}$	***jisyu*** “surrender oneself” 自首 ***jisyuu*** “self-study” 自習

Watáshitachi-wa	***x* (target)**	*désukara*	*shinpai-iri-mas-én*
We-TOP	**x (target)**	because/therefore	worry-need-be-NEG

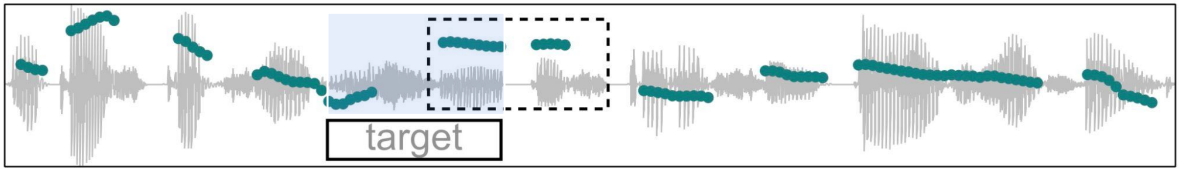
Medial: [Because we are x (we are) fine]$_{IP}$

Final: [We are x.]$_{IP}$ [Therefore (we are) fine]$_{IP}$

Stimulus examples

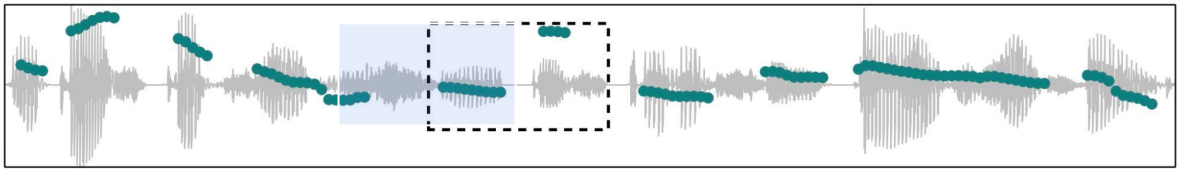
- Only pitch cues are manipulated

unaccented medial

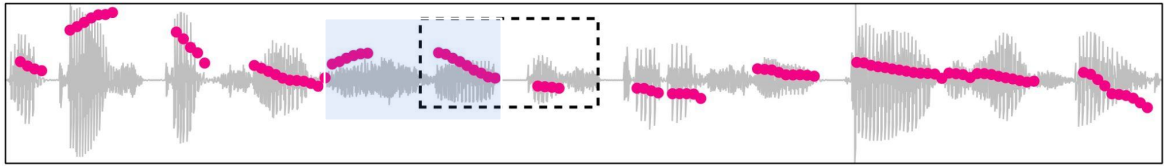


wata'shitachi-wa (target) de'sukara shim pai -iri-mas-en

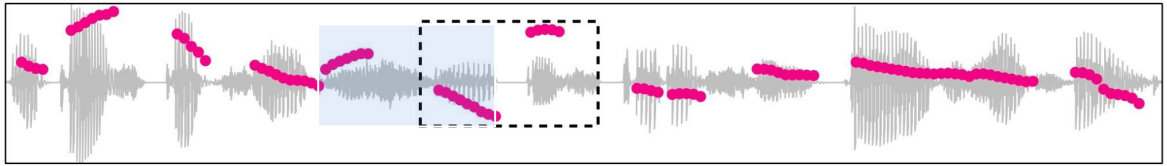
unaccented final



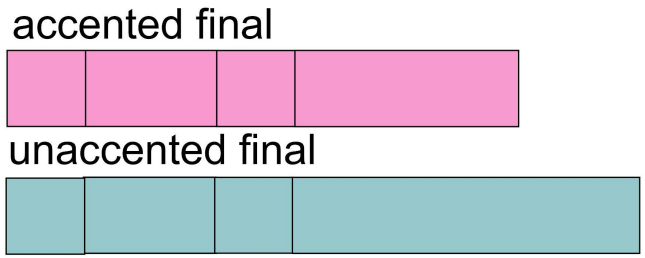
accented medial

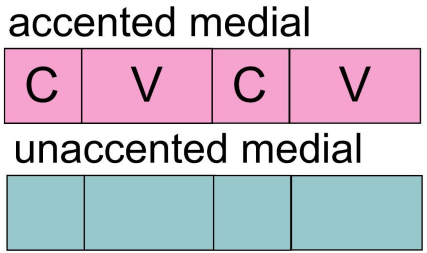


accented final



Predictions





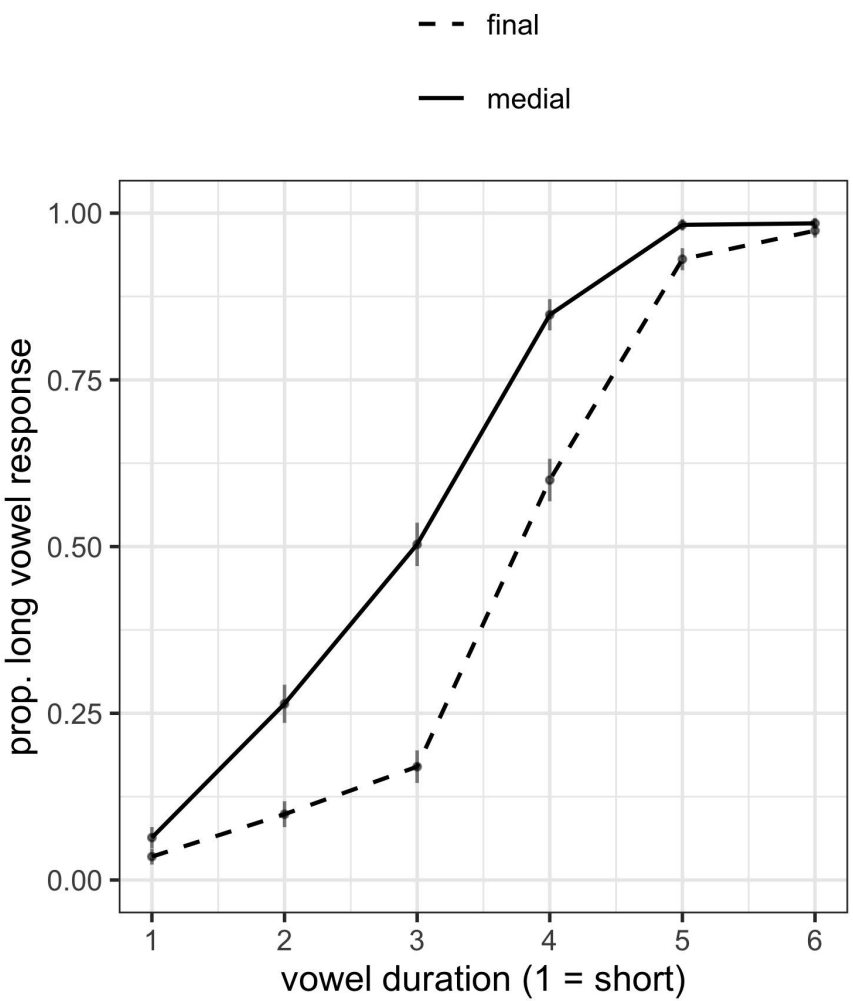
1. Boundary: Final targets require longer duration for perception of long vowel
   Empirical: decreased long vowel responses when final

2. Prominence: Unaccented final targets require even longer duration, as compared to accented final targets
   Empirical: interaction between phrasing and accent

Results: Boundary

Main effect of boundary:

β = 1.65 p < 0.001



Modeling: Mixed effects logistic regression - maximally specified random slopes that allowed convergence

Response ~ duration *prominence* boundary + (1+duration+prominence+boundary | participant)

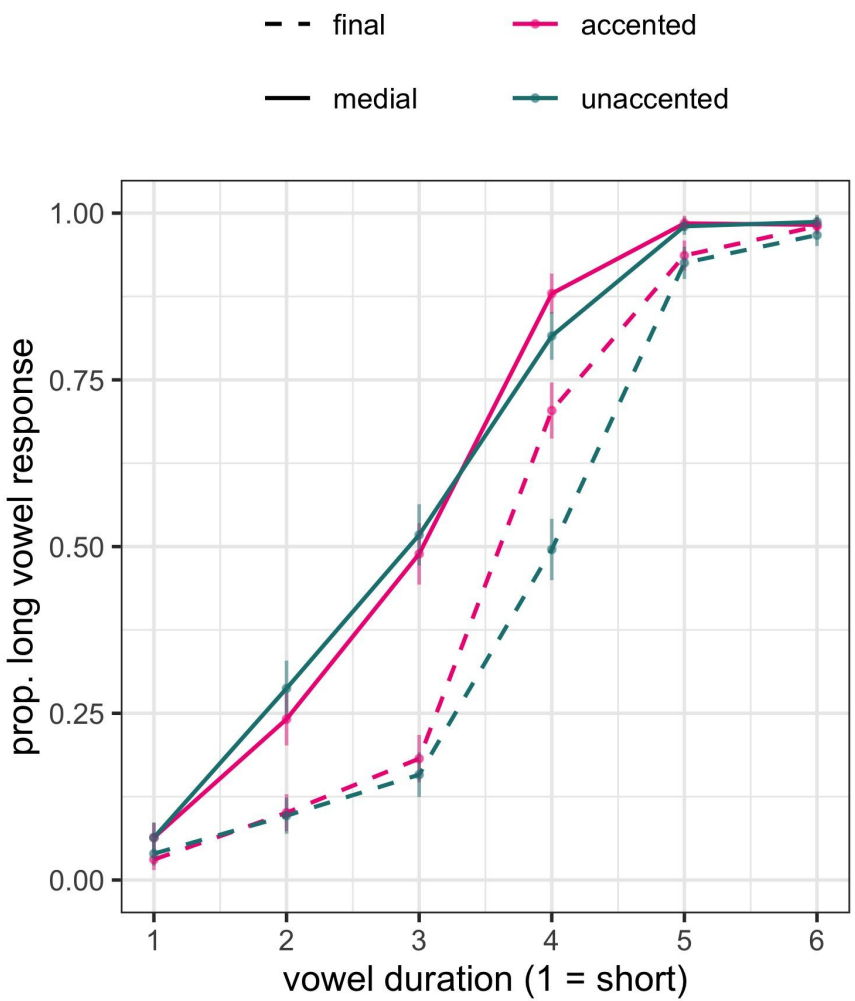
Results: Prominence

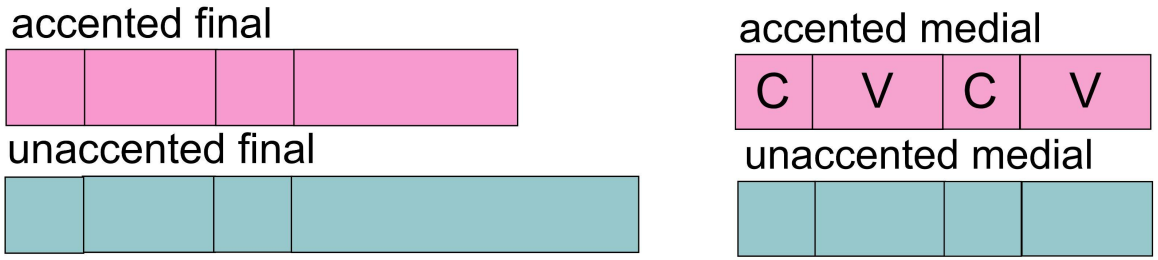
Interaction: prominence and phrasing

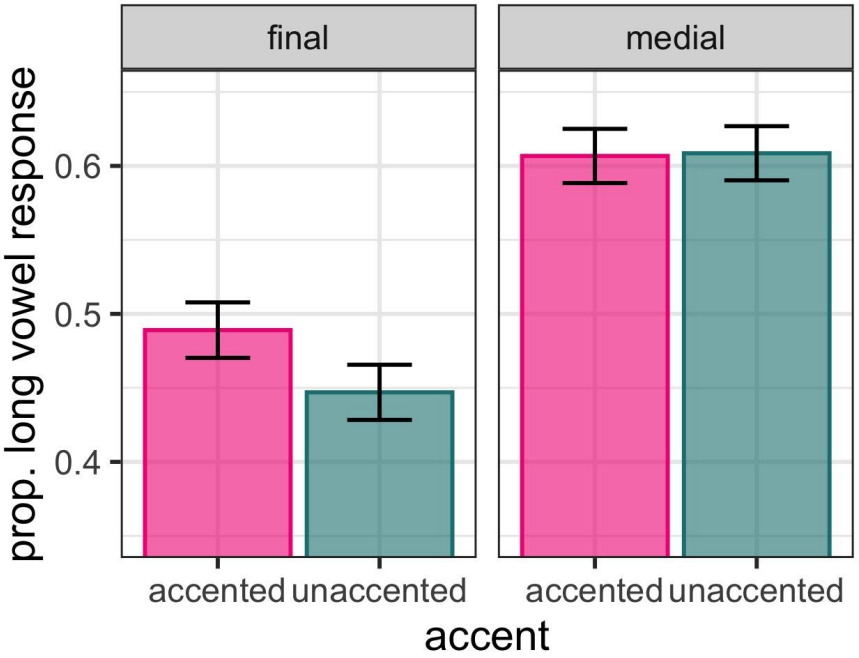
β = -0.47; p < 0.01

Effect of accent only when final

- medial β = 0.05; p = 0.74
- final β = 0.52; p < 0.01







Take home:

Prominence-boundary interactions play out in speech perception

Future:

- Other languages?
- Other/additive cues?

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