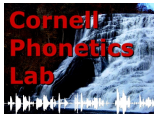


# Effects of onset consonants on the timing of pitch accents in Serbian

Robin Karlin  
Cornell University

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LSA 2018  
January 4-7, Salt Lake City, UT

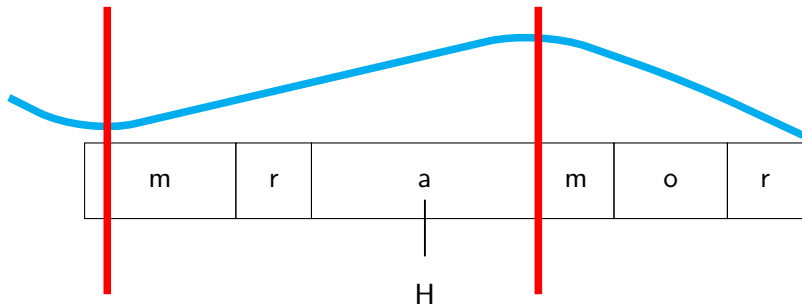


## Theories of tone timing: Segmental anchoring

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- ▶ Tones in the representation are associated to segmental structures; phonetically mapped to the string (Arvaniti et al., 1998; Prieto, 2011)
  - ▶ Both ends of pitch excursions are “anchored” to specific segmental landmarks
  - ▶ Targets do not necessarily have to phonetically align with the structure they are associated with



## Theories of tone timing: Articulatory Phonology

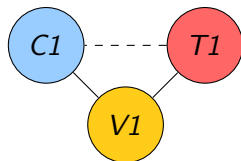
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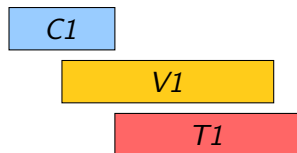
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# Theories of tone timing: Articulatory Phonology

- ▶ Timing relationships included in underlying representation (Browman and Goldstein, 1989, 1992)
  - ▶ Tone gestures coordinated alongside segmental gestures (Gao, 2008; Karlin, 2014; Yi, 2014)
  - ▶ Gestural “c-center” has been proposed for tone gesture coordination



—— in-phase  
---- anti-phase



# Theories of tone timing: Differences

- ▶ Which end of the pitch excursion can be timed?
  - ▶ Segmental anchoring advocates for both
  - ▶ Articulatory anchoring advocates for only the onset
- ▶ Where can the pitch excursion align?
  - ▶ Segmental anchoring is a little more permissive
  - ▶ C-center makes very specific predictions (for the onset of the gesture)

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- ▶ Focusing on falling accents
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- ▶ Three real words used as the “base”
  - ▶ *mrâve*                    /'mra:<sub>H</sub>ve/                    'ant.PL.ACC'
  - ▶ *mrämor*                /'mra<sub>H</sub>mor/                    'marble.ACC'
  - ▶ *mrämora*               /'mra<sub>H</sub>mora/                    'marble.GEN'

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  - ▶ *mràmora* /'mra<sub>H</sub>mora/ 'marble.GEN'
- ▶ Varied syllable onset to form sets of “perfect rhyme” words

▶ **mr**âve

▶ **ml**âve

▶ **m**âve

▶ **l**âve

▶ **r**âve

▶ **mr**àmor

▶ **ml**àmor

▶ **m**àmor

▶ **l**àmor

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Context: Nemamo ni na jednoj slici bube.  
“We don’t have insects in any picture.”

Response: Nije tačno! Imamo **mrave**.  
“That’s not true! We have ants.”

Context: Imamo sve slike izlomljenih minerala.  
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Response: Nije tačno! Nemamo **mramora**.  
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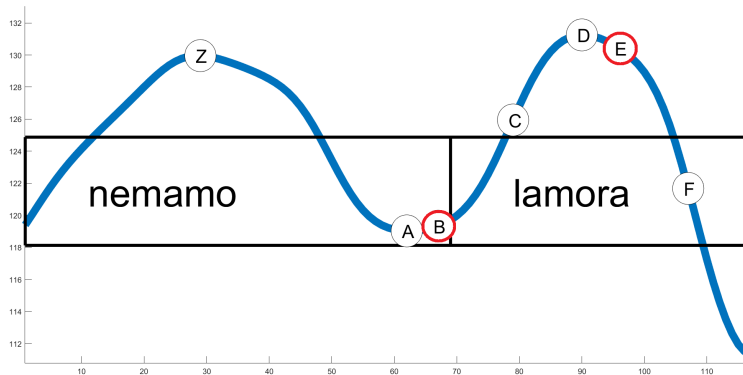
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- ▶ Cleaned dataset contains 429 tokens

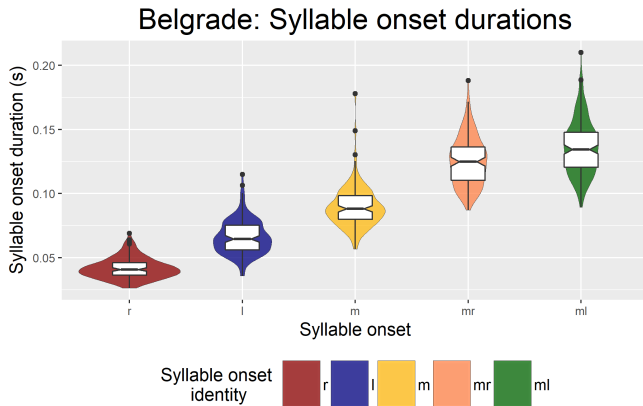
# Pitch landmarking



- ▶ **Peak offset (E):** Used to mark the peak
- ▶ **Excursion onset (B):** Used to mark beginning of pitch excursion

# Syllable onset duration

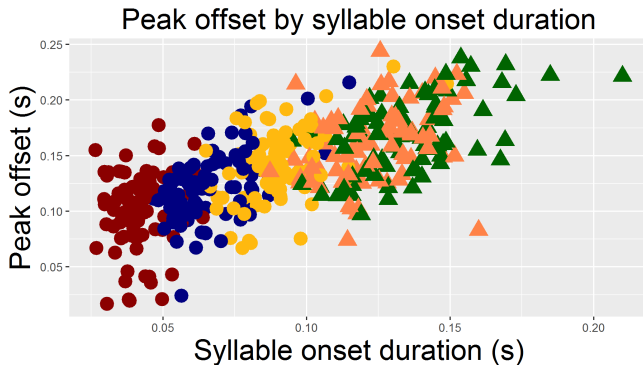
- ▶ /r/ < /l/ < /m/ < /mr/ < /ml/





## Peak alignment relative to word edge

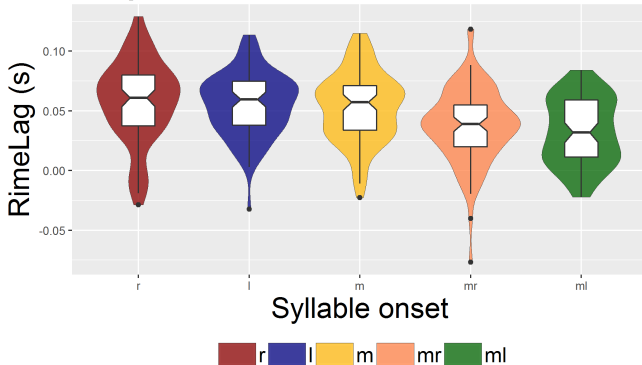
- ▶ The longer the syllable onset, the later the peak ( $p < 0.0001$ )



## Peak alignment relative to rime edge

- ▶ However, not exactly a one-to-one relationship: shifts do not fully compensate for the duration of the onset

### Belgrade: Rime onset to peak offset



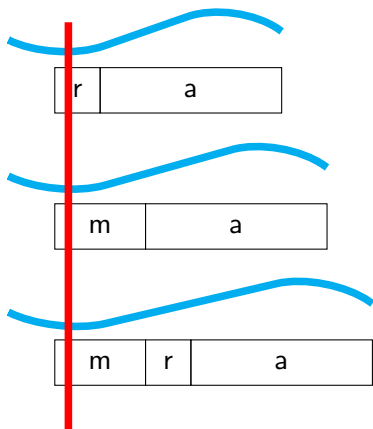
## Peak alignment relative to rime edge

- ▶ Phonological complexity explains more variation in RimeLag than the phonetic duration of the onset does

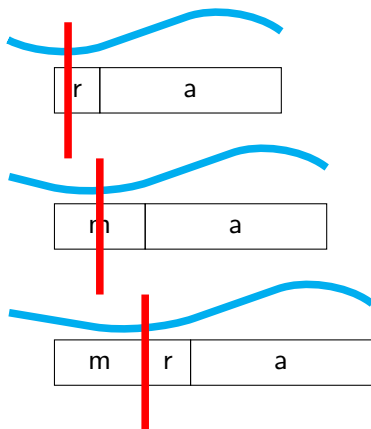
Model for RimeLag	$\chi^2$	DegF	p <sup>†</sup>
OnsDur + (1 Subj)	—	—	—
OnsDur + Complexity + (1 Subj)	7.57	1	0.006*
Complexity + (1 Subj)	—	—	—
Complexity + OnsDur + (1 Subj)	2.96	1	0.085

# Excursion characteristics: two possibilities

1. Increase excursion duration



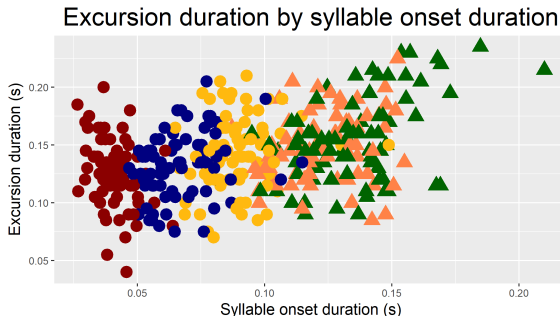
2. Delay start of excursion



## Excursion characteristics: duration

- ▶ Longer syllable onsets correlated with longer pitch excursions (peak offset time - excursion onset time)

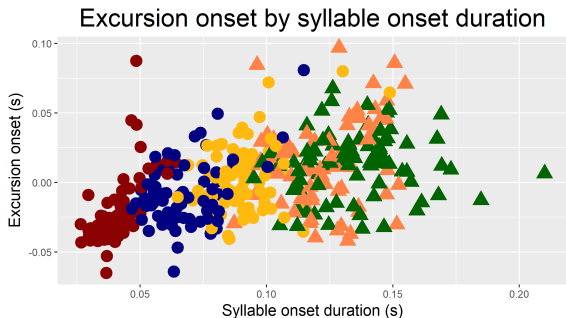
Model for ExcurDur	$\chi^2$	DegF	p <sup>†</sup>
1 + (1 Subj)	—	—	—
OnsDur + (1 Subj)	73.40	1	<0.0001**
OnsDur + Complexity + (1 Subj)	0.01	1	0.91
OnsDur + Complexity + Complexity:OnsDur + (1 Subj)	1.72	1	0.19



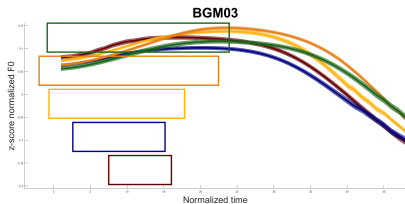
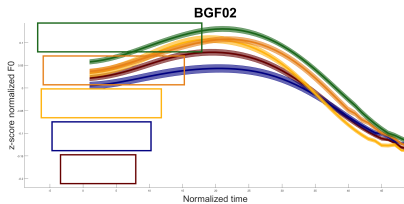
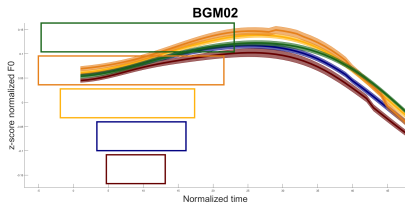
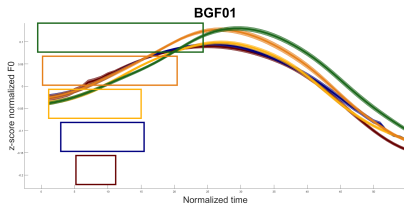
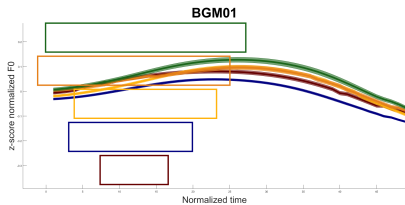
## Excursion characteristics: timing of beginning

- ▶ Pitch movements start later with longer syllable onsets (excursion onset time - word beginning)

Model for ExcurOnset	$\chi^2$	DegF	p <sup>†</sup>
1 + (1 Subj)	—	—	—
OnsDur + (1 Subj)	215.67	1	< 0.0001**
OnsDur + Complexity + (1 Subj)	20.11	1	< 0.0001**
OnsDur + Complexity + Complexity:OnsDur + (1 Subj)	0.22	1	0.64



# Excursion characteristics: timing of beginning



Onset identity



- ▶ Effects of **phonetics**:
  - ▶ Peak timing relative to left edge of word
  - ▶ Duration of excursion
- ▶ Effects of **phonology**:
  - ▶ Peak timing relative to rime
  - ▶ Timing of beginning of excursion



# Discussion

- ▶ Effects of **phonetics**:
  - ▶ Peak timing relative to left edge of word
  - ▶ Duration of excursion
- ▶ Effects of **phonology**:
  - ▶ Peak timing relative to rime
  - ▶ Timing of beginning of excursion
- ▶ Gestural theories need a clear hypothesis regarding where tone gesture duration comes from

## Future (/other) work

- ▶ Further probing of articulatory patterns with acoustic data
  - ▶ Is it really complexity, or is it simply a “threshold” of duration?
  - ▶ Effect of even more complex onset clusters on pitch timing
- ▶ Verification with articulatory data
- ▶ Different configurations and strategies for different dialects (Karlin, 2018)
  - ▶ Valjevo Serbian (second dialect; minimally different)
    - ▶ Peaks phonetically occur earlier
    - ▶ Only excursion duration differs (NOT the timing of the start of the pitch excursion!)

Thank you!

## References

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