TEMPORAL COORDINATION AND SONORITY OF JAZANI ARABIC WORD-INITIAL CLUSTERS

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OUTLINE

1. Introduction and Background
   - Arabic syllable structure
   - C-Center organization and relevant studies
   - Temporal co-ordination modulated by SSP
2. The present study
   - Research questions
   - Results
   - Conclusion

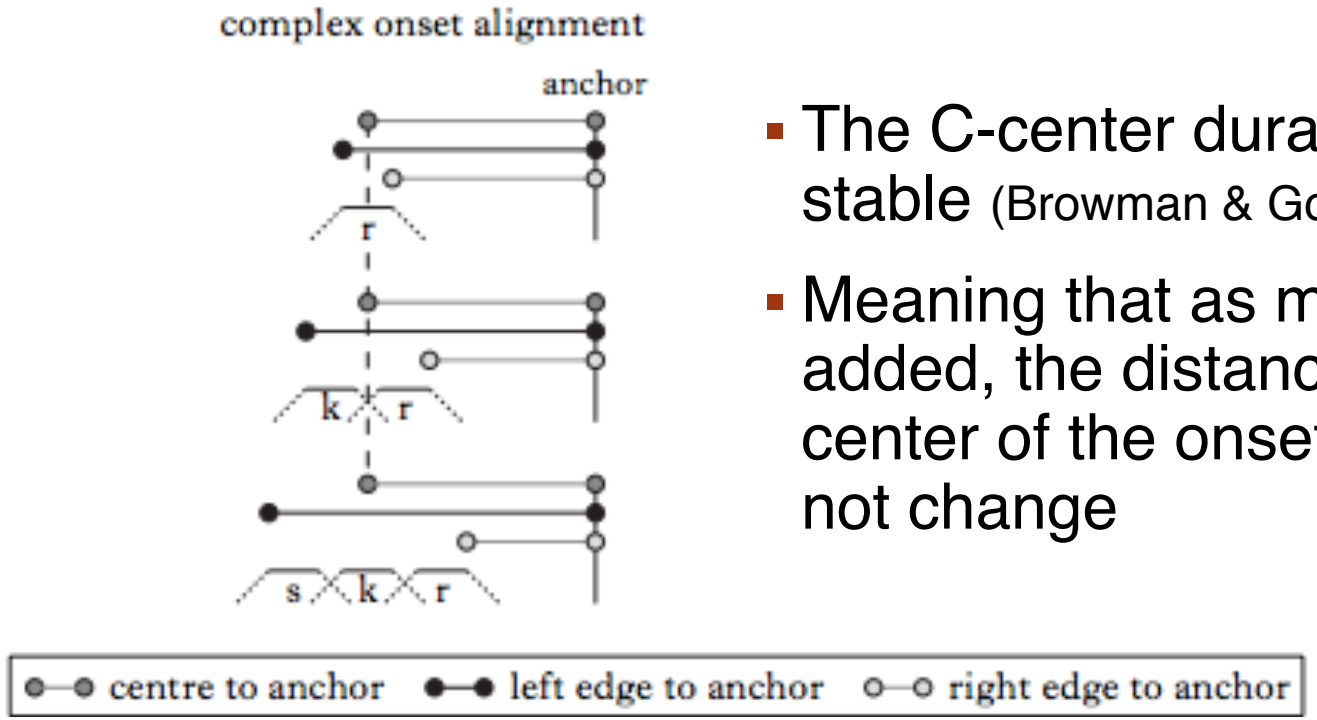
ARABIC SYLLABLE STRUCTURE

- Classical and Standard Arabic do not have word-initial consonant clusters (Kiparsky 2003; Abushihab 2010; Aquil 2012)
  - However, some Arabic dialects have them - Moroccan, Jazani and Najdi Arabic (Abboud 1979; Benhallam 1980; Boudlal 2001)
- While English has been standardly argued to have complex onsets, syllabic organization of word-initial clusters is a contested issue in Arabic dialects
- For example, in Moroccan Arabic:
  - Complex onset (Benhallam 1980) : [kra] 'rent'
    [skru] 'his ploughshares'
  - More recently, Simplex onset (Boudlal 2001) : [k.ra]
    [sk.ru]

THE TEMPORAL PATTERNS TO PROBE SYLLABIC AFFILIATION

- Temporal stability patterns can show syllabic organization (Browman & Goldstein 1988)
- Analyzed articulatory data from the Tokyo x-ray microbeam database, consisting of sets of nonsense words with shifted word boundaries.
  - e.g. [… **spla**ts] vs. [… **pla**ts]
- Measured the duration from the end of the vowel to three different points in the cluster.
  - Left-edge, Right-edge, C-center (average of the midpoints of all onset consonants)
- C-center the most consistent (least variant)

WHAT DOES A WORD-INITIAL CONSONANT SEQUENCE LOOK LIKE IN ENGLISH?



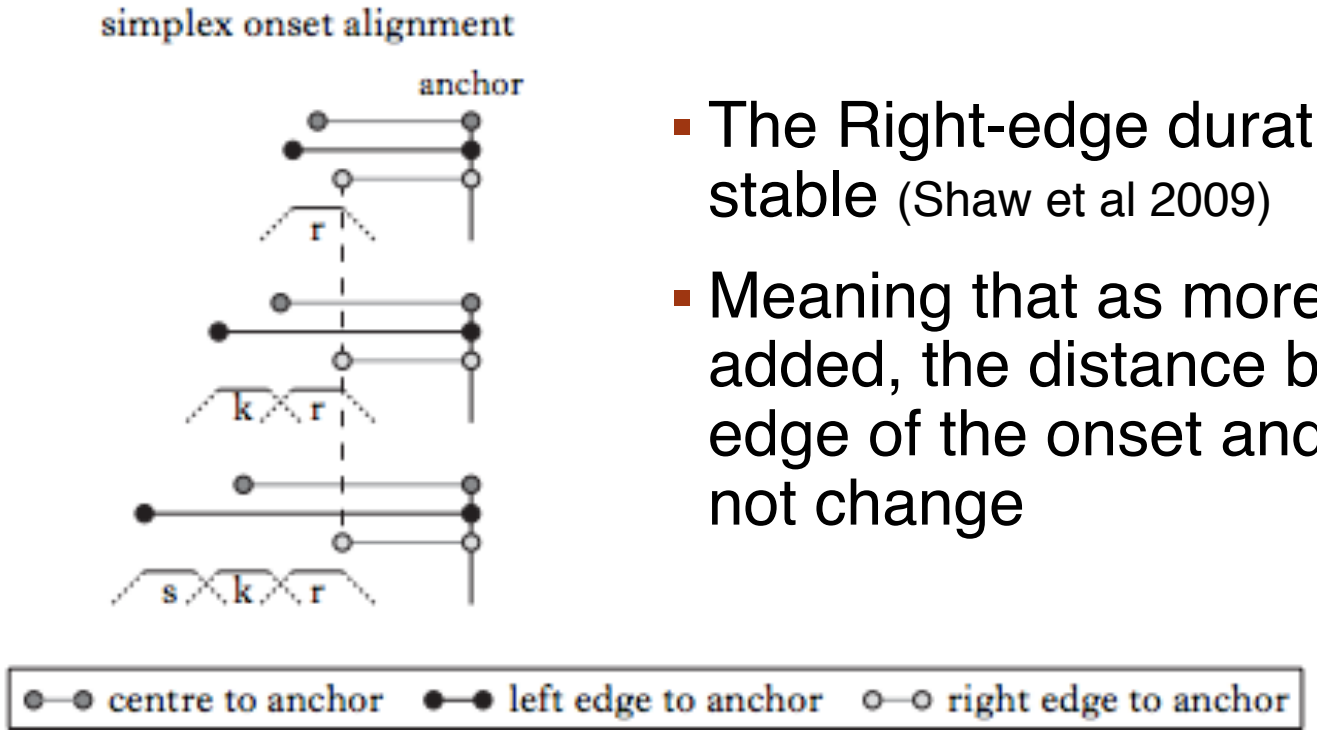
- The C-center duration is the most stable (Browman & Goldstein 1988)
- Meaning that as more consonants are added, the distance between the C-center of the onset and the anchor does not change

Figure: Shaw, Jason et al. (2009). "Syllabification in Moroccan Arabic: evidence from patterns of temporal stability in articulation." Phonology 26.1, pp. 187–215.

BACKGROUND: SHAW ET AL (2009)

- Applied similar metrics to Moroccan Arabic (MA) using electromagnetic-articulography (EMA), where the Right-edge alignment was most consistent, rather than C-center
  - i.e., a sequence of consonants at the beginning of a word need not all be part of the same syllable

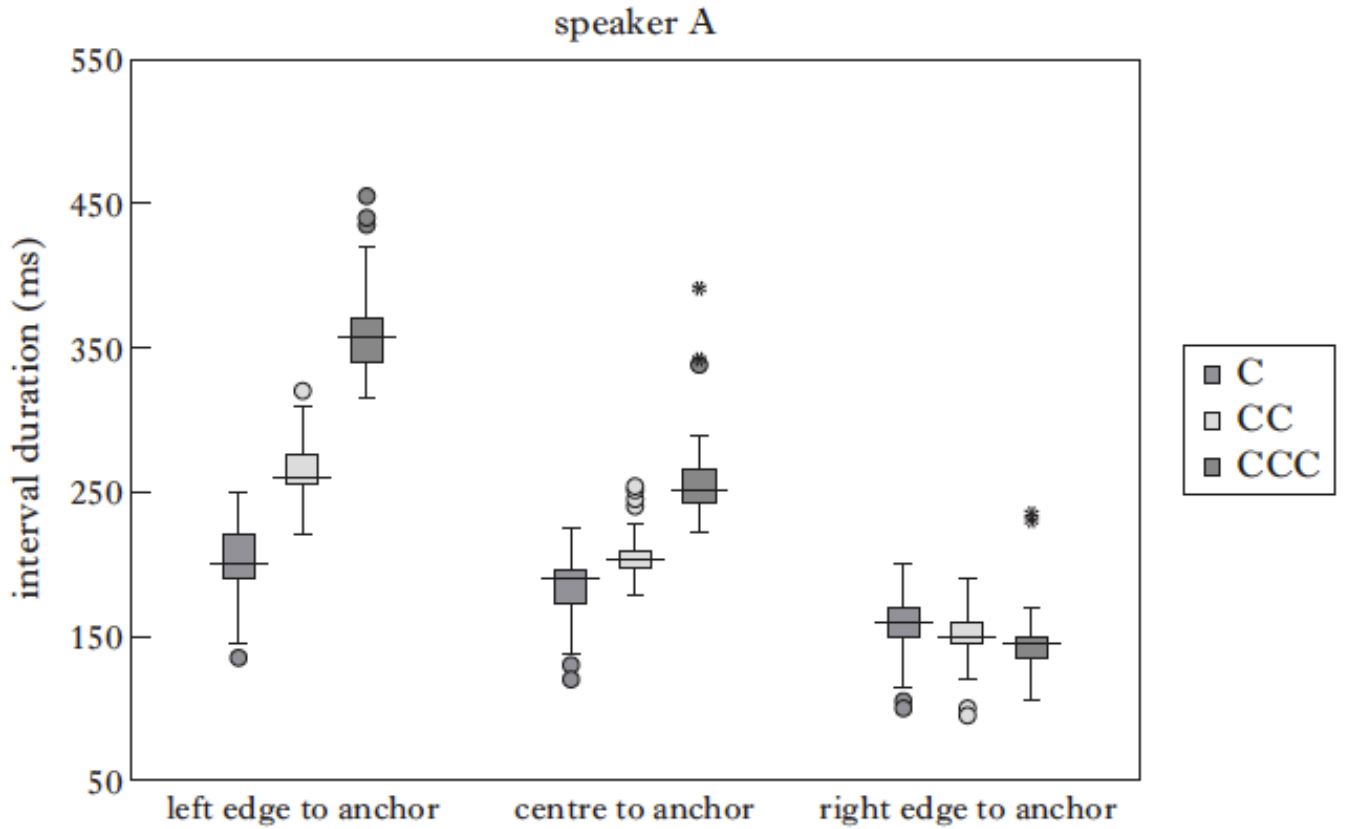
WHAT DOES A WORD-INITIAL SEQUENCE LOOK LIKE IN MOROCCAN ARABIC?



- The Right-edge duration is the most stable (Shaw et al 2009)
- Meaning that as more consonants are added, the distance between the Right-edge of the onset and the anchor does not change

Figure: Shaw, Jason et al. (2009). "Syllabification in Moroccan Arabic: evidence from patterns of temporal stability in articulation." Phonology 26.1, pp. 187–215.

WHAT DOES A WORD-INITIAL SEQUENCE LOOK LIKE IN MOROCCAN ARABIC?



Data from: Shaw, Jason et al. (2009). "Syllabification in Moroccan Arabic: evidence from patterns of temporal stability in articulation." Phonology 26.1, pp. 187–215.

TWO DIFFERENT SYLLABLE STRUCTURES FOR THE SAME SEQUENCE

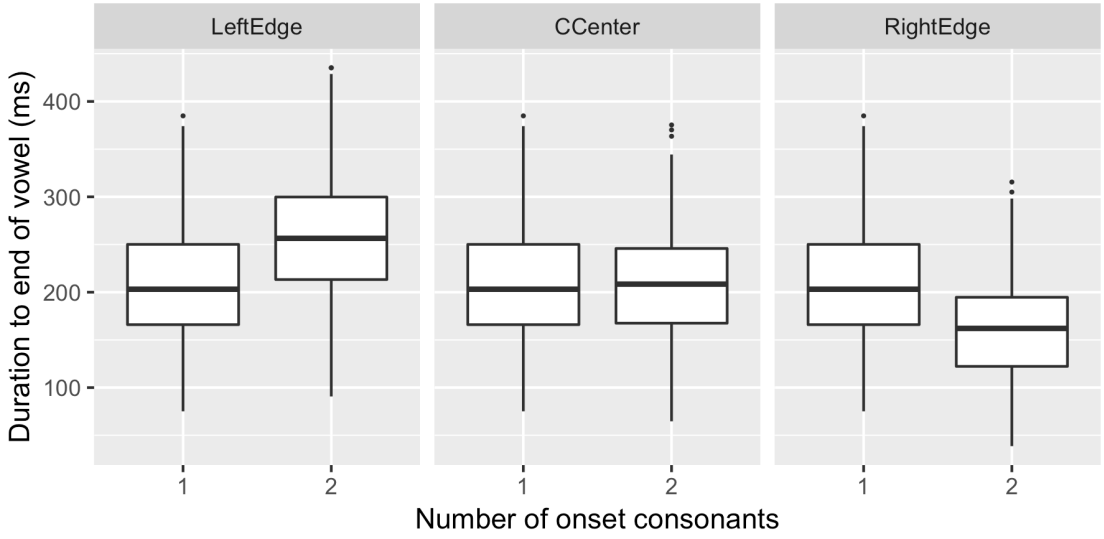
- From previous studies, we can learn that:
  - In English, both consonants of a CCV sequence are in the same onset, and there is a C-center effect
  - In Moroccan Arabic, the consonants of a CCV sequence are **not** in the same onset, and there is a Right-edge effect
- Therefore, we can use the C-center effect to identify onset/syllable structure
  - If a consonant sequence belongs to the same onset (or syllable), then there should be a C-center effect
  - If a consonant sequence has consonants that are not part of the same onset (or syllable), there should **not** be a C-center effect

SONORITY SEQUENCING PRINCIPLE (SSP) AND TEMPORAL CO-ORDINATION

- Italian word-initial clusters (Hermes, Mücke, and Grice 2013)
  - Rising sonority (e.g. /pr/) shows C-center effects
  - Falling sonority (e.g. /sp/) shows right-edge coordination

ACOUSTIC MEASUREMENTS

- Most, if not all, previous related work employed gestural coordination through articulatory techniques
- Selkirk & Durvasula (2013) showed using acoustic recordings that a C-center effect was observable for English speakers in word-initial consonant sequences
  - Recently replicated with different set of stimuli (Durvasula & McCabe, in prep)



THE PRESENT STUDY

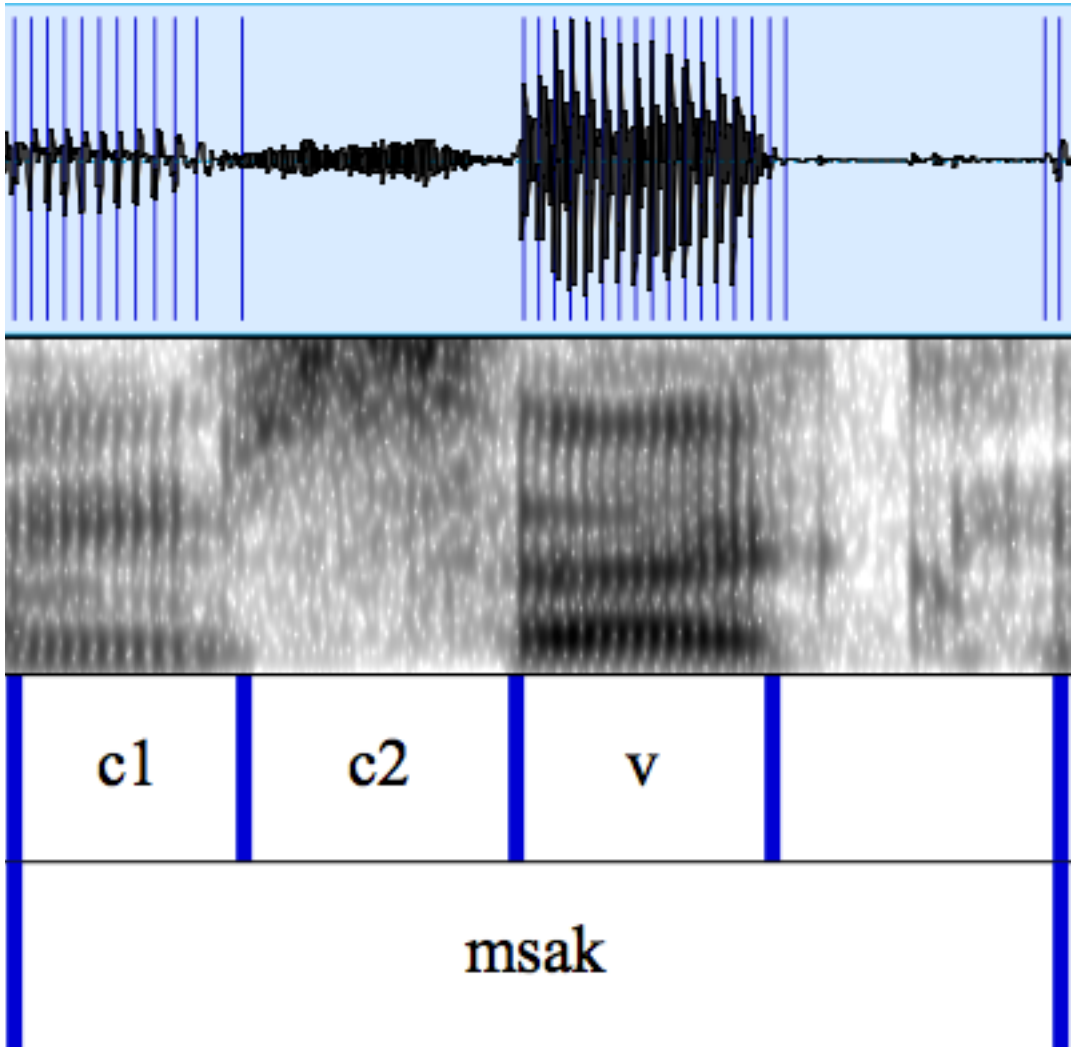
- What is the syllabic organization of word-initial clusters in Jazani Arabic?
  - By testing which is the most consistent temporal organization (Left-edge, Right-edge, C-Center)
  - The right-edge of the consonant sequence is most stable
  - It suggests a simplex onset organization
- Does the syllabic organization vary with the different sonority profiles?
  - Rising /sm/ [smaʔ] ‘listen’
  - Falling /nz/ [nzel] ‘get down’
  - Equal /nm/ [nmosˁ] ‘pluck’
  - No it doesn’t

METHODS

- Acoustic measurements (Audacity)
- 7 native male speakers of Jazani Arabic (living in Jazan Province, Saudi Arabia)
  - Age range: 20 – 40 years
- Test Items
  - 78 target words
  - 39 pairs (18 Falling, 17 Rising, 4 Equal sonority)

METHODS (CONTD)

- Test Items
  - 34 real word, 44 nonce word
    - Nonce words used due to lack of real word for some sequence combinations
  - e.g. Real: *ħmad ~ mad,* *smaʕ ~ maʕ,* *nmosˠ ~ mosˠ*
- Each word repeated 6 times
- Words displayed on computer screen
- Carrier phrase: [*ʔɪnta ..... marah θanjah*] "You …. Again"
- Recordings were manually annotated by one of the authors



PRAAT ANNOTATION

- “c1” for the first consonant of the CC
- “c2” for the second consonant
- And “c2” for the C in a singleton

DATA ANALYSIS

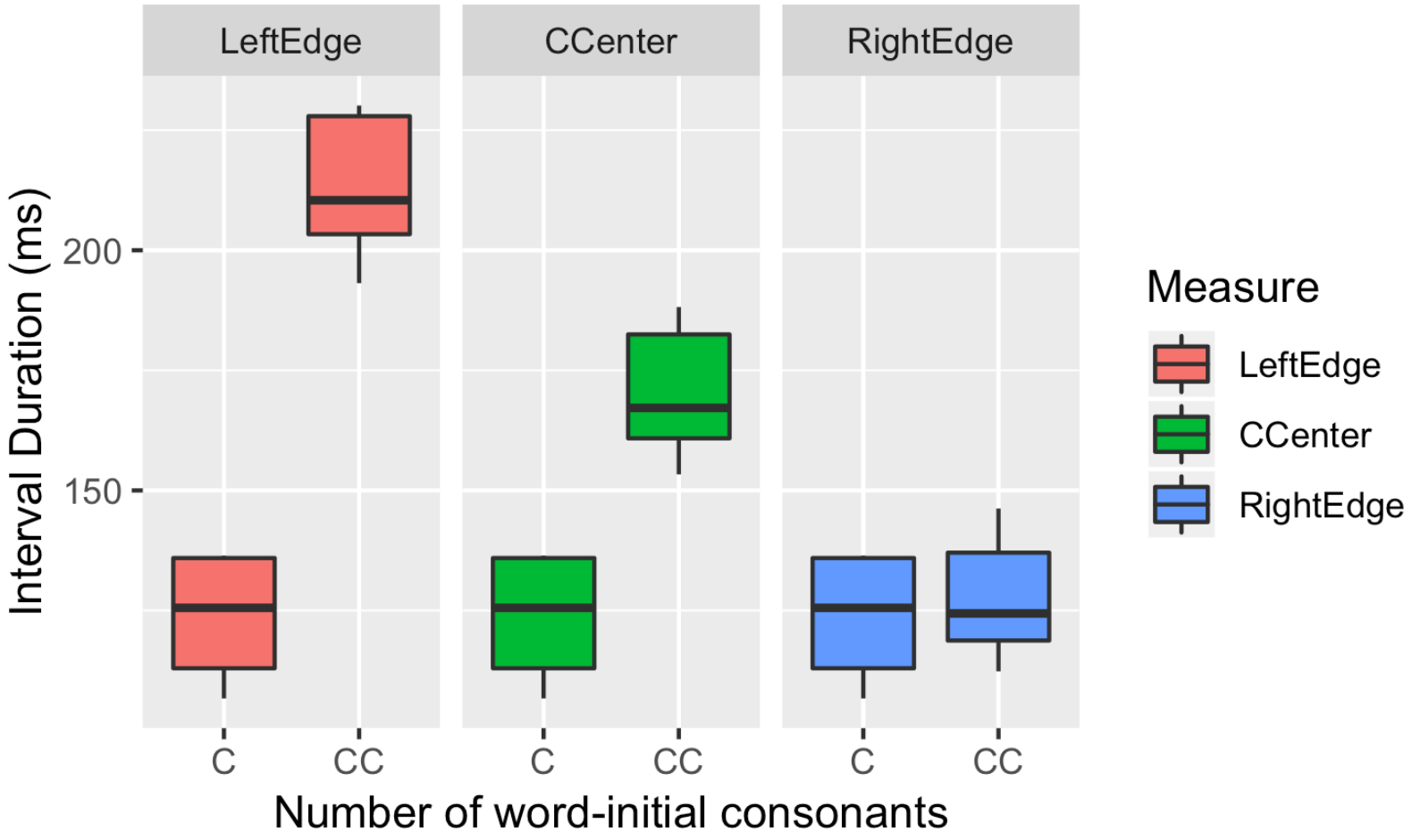
- Praat scripts were used to get the Left-edge, C-center, and Right-edge durations, each to the end of the vowel, for each token

- R was used to calculate the Relativized Standard Deviation (RSD) of each set of token doublets, and to create a plot of it
  - RSD is an unbiased measure of variability

FIRST QUESTION

- What is the syllabic organization of word-initial clusters in Jazani Arabic?

LEFT EDGE, C-CENTER, AND RIGHT EDGE INTERVAL DURATIONS

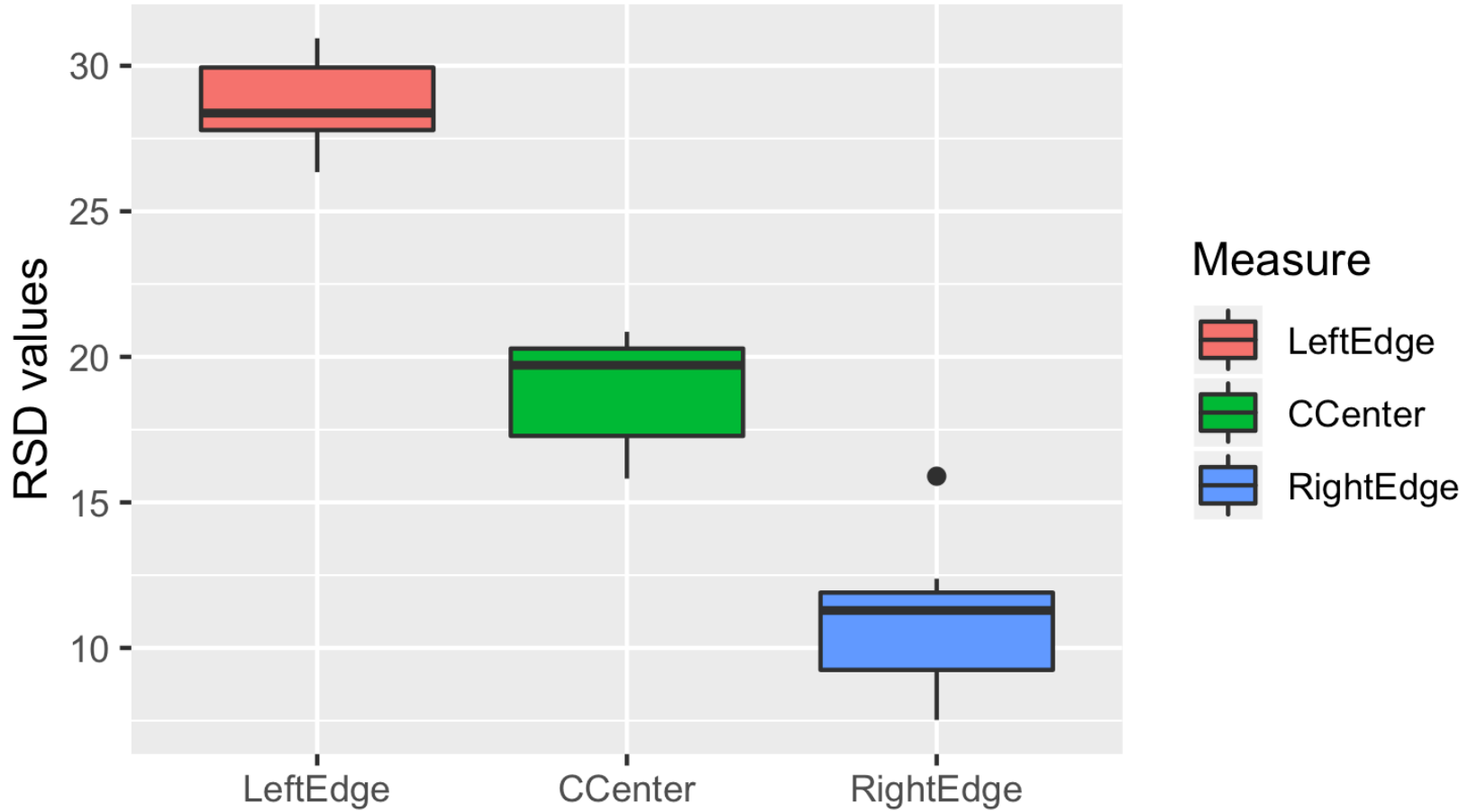


LOWEST RSD FOR DIFFERENT PAIRS (SAMPLES)

Pairs	Left-Edge	C-center	Right-edge
ħmad - mad	29.8	18.5	**10.7**
ħmaf - maf	30.5	19.6	**11.9**
nfad- fad	28.1	18.5	**11.5**
smaʕ - maʕ	31.6	21.2	**15.4**

Table 1: A sample set of RSD values for pairs across 7 speakers

RSD VALUES FOR THE THREE INTERVALS



SUMMARY

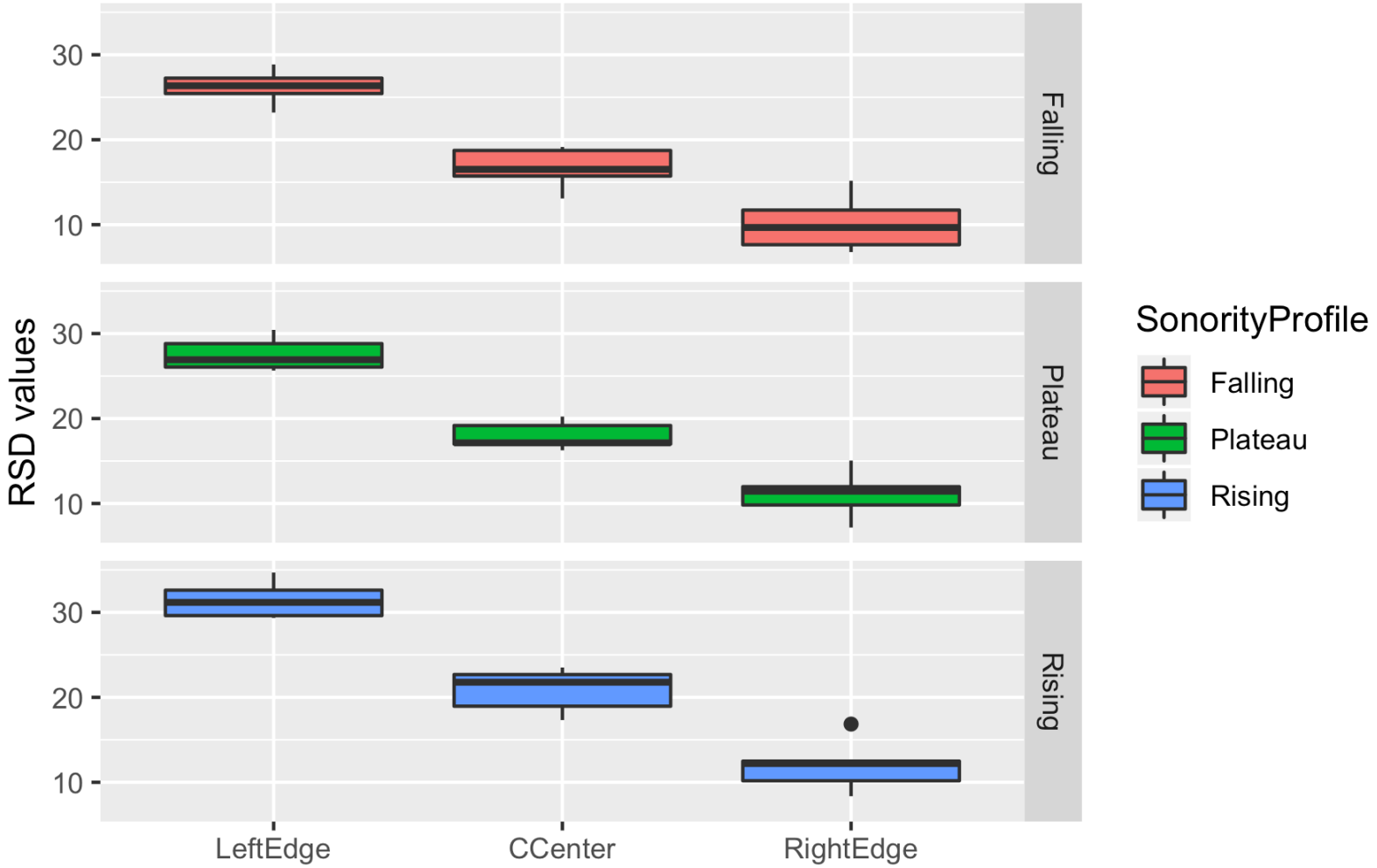
- The Left-edge and the C-center intervals are less stable
- The Right-edge interval is the most stable
- Jazani Arabic shows temporal pattern of simplex onset organization

CCVX → C.CVC [dʒ.maʕ] *'count'*

SECOND QUESTION

- Does the syllabic organization vary with the different sonority profiles?

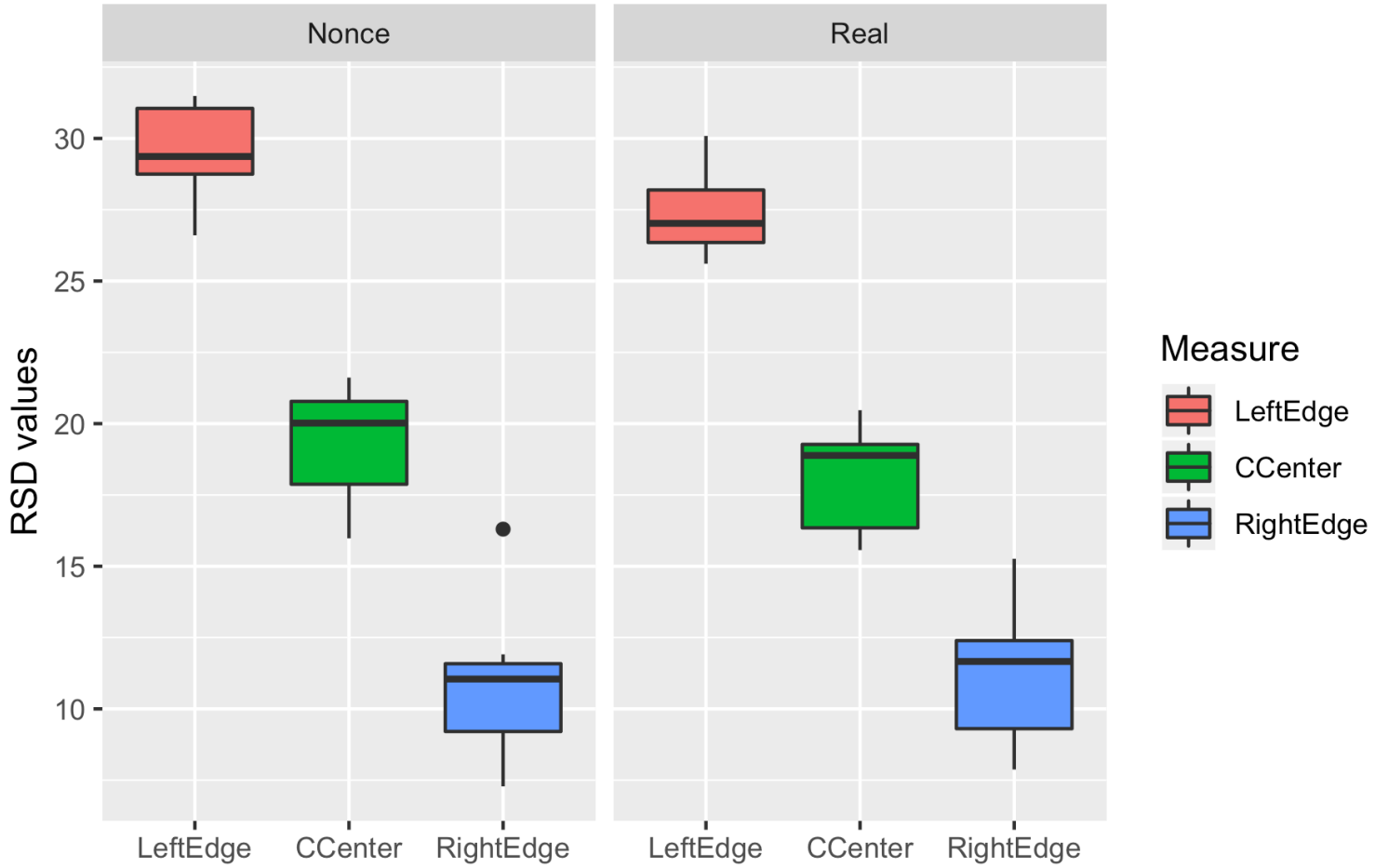
RSD VALUES BY SONORITY PROFILE



SUMMARY

- Word-initial clusters with different sonority profiles all behave as simplex onsets

RSD VALUES BY REAL AND NONCE WORDS



CONCLUSION

- Unlike English, but similar to MA, Jazani Arabic word-initial consonant clusters are simplex onsets
- Unlike Italian, all different sonority profiles behave as simplex onsets
- Real and nonce words have a similar pattern
- Acoustic methods (with well chosen stimuli) can be a good tool to study c-center effects, and thereby onset organization
  - Given how accessible they are, they really open up the possibility of studying a much wider variety of languages

ACKNOWLEDGMENT

- Jazan speakers from the Jazan Province, Saudi Arabia
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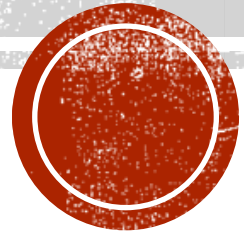
THANK YOU!



QUESTIONS & COMMENTS