ANIKO KOVAČ
SAARLAND UNIVERSITY
ANIKOK@COLI.UNI-SAARLAND.DE

MAJA MARKOVIĆ
UNIVERSITY OF NOVI SAD
MAJAMARKOVIC@FF.UNS.AC.RS

A Rule-Based Syllabifier for Serbian

UNIVERSITÄT
DES
SAARLANDES

UNIVERSITAS STUDIORUM NEOPLANTENSIS MCMLX

ФИЛОЗОФСКИ ФАКУЛТЕТ НОВИ САД

WHAT DID WE SET OUT TO DO?

The Goal

i) Develop a system for automatic rule-based syllabification for Serbian

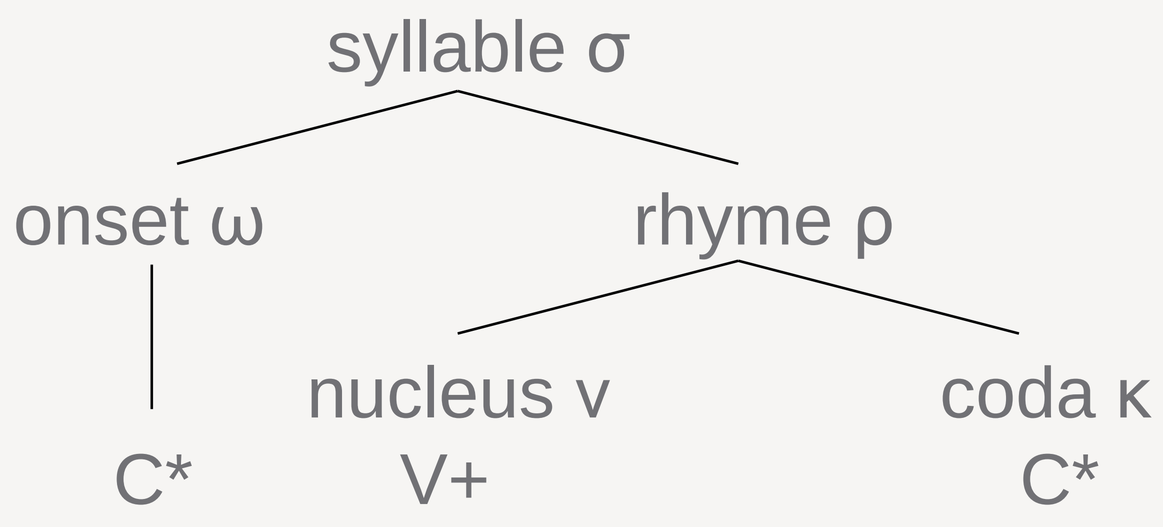
ii) Provide an analysis of the outcomes to address theoretical considerations and serve as a basis for the development of future syllabifiers

iii) Present syllable distribution data for Serbian

WHY RULE-BASED?

Our Approach

- Rule-based vs. data-driven
- Existing rule descriptions:
  Gramatika srpskoga jezika by Stanojčić and Popović (2005)
  + Kašić (2014)
  + Zec (2000)



syllable σ

onset ω

rhyme ρ

nucleus ν

coda κ

C*

V+

C*

A Rule-Based Syllabifier for Serbian

HOW DID WE SEGMENT?

The Rules

(1) In words made up of multiple phonemes, consonants, sonorants and vowels, the syllable boundary comes **after the vowel and before the consonant**.

či-ta-ti [to read]

(2) ~~Medially, in a consonant cluster which has an affricate or fricative sound in its initial position, the syllable boundary will be before that consonant cluster.~~

po-šta [post]

(3) ~~The syllable boundary will be before a consonant cluster if, in a consonant cluster found medially in a word, the second position in the cluster is occupied by one of the sonorants v, j, r, l or lj preceded by any other consonant besides a sonorant.~~

sve-tlost [light]

HOW DID WE SEGMENT?

The Rules

(1) In words made up of multiple phonemes, consonants, sonorants and vowels, the syllable boundary comes **after the vowel and before the consonant**.

či-ta-ti [to read]

(2) ~~Medially, in a consonant cluster which has an affricate or fricative sound in its initial position, the syllable boundary will be before that consonant cluster.~~

po-šta [post]

(3) ~~The syllable boundary will be before a consonant cluster if, in a consonant cluster found medially in a word, the second position in the cluster is occupied by one of the sonorants v, j, r, l or lj preceded by any other consonant besides a sonorant.~~

sve-tlost [light]

tr-ča-ti [to run]
r-va-ti se [to wrestle]

HOW DID WE SEGMENT?

The Rules

(1) In words made up of multiple phonemes, consonants, sonorants and vowels, the syllable boundary comes **after the vowel** **or sonorants r, l and n in syllable bearing positions** **and before the consonant**.

či-ta-ti [to read]

(2) ~~Medially, in a consonant cluster which has an affricate or fricative sound in its initial position, the syllable boundary will be before that consonant cluster.~~

po-šta [post]

(3) ~~The syllable boundary will be before a consonant cluster if, in a consonant cluster found medially in a word, the second position in the cluster is occupied by one of the sonorants v, j, r, l or lj preceded by any other consonant besides a sonorant.~~

sve-tlost [light]

tr-ča-ti [to run]
r-va-ti se [to wrestle]

HOW DID WE SEGMENT?

The Rules

(4) If a consonant cluster consists of **two sonorants**, the syllable boundary will be **between them** so that one sonorant belongs to the preceding, and one sonorant belongs to the following syllable.

lom-ljen [broken]

(5) If a consonant cluster consists of a **plosive** in its initial position and **some other consonant except the sonorants j, v, l, lj and r**, the syllable boundary will be **between** the consonants.

lep-tir [butterfly]

(6) If in a cluster of two sonorants, the **second position is occupied by the sonorant j from je** corresponding to the **ijekavica dialect** to e in the ekavica dialect, the syllable boundary will be **before that group**.

čo-vjek [man]

HOW DID WE SEGMENT?

The Rules

(4) If a consonant cluster consists of **two sonorants**, the syllable boundary will be **between them** so that one sonorant belongs to the preceding, and one sonorant belongs to the following syllable.

lom-ljen [broken]

(5) If a consonant cluster consists of a **plosive** in its initial position and **some other consonant except the sonorants j, v, l, lj and r**, the syllable boundary will be **between** the consonants.

lep-tir [butterfly]

(6) If in a cluster of two sonorants, the **second position is occupied by the sonorant j from je** corresponding to the **ijekavica dialect** to e in the ekavica dialect, the syllable boundary will be **before that group**.

čo-vjek [man]

gu-ngula [commotion]
mo-mci [boys]

HOW DID WE SEGMENT?

The Rules

(4) If a consonant cluster consists of **two sonorants**, the syllable boundary will be **between them** so that one sonorant belongs to the preceding, and one sonorant belongs to the following syllable.

lom-ljen [broken]

(5) If a consonant cluster consists of a **plosive** **or nasal** in its initial position and **some other consonant except the sonorants j, v, l, lj and r**, the syllable boundary will be **between** the consonants.

lep-tir [butterfly]

gu-ngula [commotion]
mo-mci [boys]

(6) If in a cluster of two sonorants, the **second position is occupied by the sonorant j from je** corresponding to the **ijekavica dialect** to e in the ekavica dialect, the syllable boundary will be **before that group**.

čo-vjek [man]

HOW DID WE SEGMENT?

The Rules

(7) The sonorant r can be a syllable carrier in standard Serbian when:

a. it is found medially between two consonants,

tr-ča-ti [to run]

b. it is found initially before a consonant,

r-va-ti se [to wrestle]

c. it is found after a vowel in compounds,

za-r-đa-ti [to rust]

d. before o that is realized as an l in other members of the paradigm.

o-tr-o (m.) from o-tr-la (f.) [wiped]

HOW DID WE SEGMENT?

The Rules

(7) The sonorant r can be a syllable carrier in standard Serbian when:

a. it is found medially between two consonants,

tr-ča-ti [to run]

b. it is found initially before a consonant,

r-va-ti se [to wrestle]

~~c. it is found after a vowel in compounds,~~

~~*za-r-đa-ti [to rust]*~~

~~d. before o that is realized as an l in other members of the paradigm.~~

~~*o-tr-o (m.) from o-tr-la (f.) [wiped]*~~

HOW DID WE SEGMENT?

The Rules

(7) The sonorant r can be a syllable carrier in standard Serbian when:

a. it is found medially between two consonants,

tr-ča-ti [to run]

b. it is found initially before a consonant,

r-va-ti se [to wrestle]

except if it is followed by the sequence *je.*

~~c. it is found after a vowel in compounds,~~

~~*za-r-đa-ti [to rust]*~~

~~d. before o that is realized as an l in other members of the paradigm.~~

~~*o-tr-o (m.) from o-tr-la (f.) [wiped]*~~

HOW DID WE SEGMENT?

The Rules

(8) The other two alveolar sonorants, l and n can be syllable carriers in:

a. dialectal toponyms,

Stlp, Vlča glava, Žlne

b. foreign toponyms,

Vltava, Plzen

c. personal names, and in

English *Idn* or Arabic *Ibn-Saud*

d. the word

bicikl [bicycle].

HOW DID WE SEGMENT?

The Rules

(8) The other two alveolar sonorants, l and n can be syllable carriers in:

a. dialectal toponyms, *Stlp, Vlča glava, Žlne*

b. foreign toponyms, *Vltava, Plzen*

c. personal names, and in English *Idn* or Arabic *Ibn-Saud*

d. the word *bicikl [bicycle]*.

???

HOW DID WE SEGMENT?

The Rules

(8) The other two alveolar sonorants, l and n, can be syllable carriers if they are found medially **between two consonants of lower sonority**, **initially before a consonant of lower sonority**, or **finally after a consonant of lower sonority**.

Stlp, Vlča glava, Žlne,
Vltava, Plzen
English *ldn* or Arabic *Ibn-Saud*
bicikl [bicycle]

HOW DID WE SEGMENT?

The Rules

(8) The other two alveolar sonorants, l and n, can be syllable carriers if they are found medially **between two consonants of lower sonority**, **initially before a consonant of lower sonority**, or **finally after a consonant of lower sonority**.

Stlp, Vlča glava, Žlne,
Vltava, Plzen
English *ldn* or Arabic *Ibn-Saud*
bicikl [bicycle]

Bern not Be-rn
Klajn not Kla-jn
Linkoln not Linko-ln

HOW ABOUT THE DATA?

The Results

- 3,607,450 word-forms in *SrpLemKor* (Popović, 2010; Utvić, 2011)
- Most frequent syllable types:
  CV (62%), CCV (12%), V (11%), and CVC (9%)
- Positional distribution data for different syllable types in monosyllabic words for the initial, medial, and final positions of polysyllabic words
- Asymmetries of syllable structures occurring only in monosyllabic words and the final position of polysyllabic words:
  CVCC, CCVCC, VCC, CVCCC, CCCVCC, VCCC, CCVCCC, CCCCVCC, and CCCVCCC
- Syllable nuclei statistics including their overall and positional frequencies in monosyllabic and polysyllabic words

HOW ABOUT THE DATA?

The Results

- ~2% noise in the data
- 6 syllable structures not found by an onset-maximization syllabifier in Croatian (Meštrović et al., 2015)

CCCCCVC *mo-na-**rhstvom***
CCCCV *se-**rbska**, **ca-rstva***
CCCCVC *de-**jstvom***
CCCCCV *se-**rbstvo***

CCCCVCC *Go-**ldštajn**, Rot-**hchild**, Ar-**mstrong***

CVCCCC *cr-no-**gorskg***

CLOSING THOUGHTS

Conclusions

- We developed a rule-based syllabifier for Serbian based on prescriptive rule descriptions.
- In the process, we discovered the shortcomings and inaccuracies of the existing prescriptive rule set.
- This approach still has some issues that should be resolved.
- A combination of onset maximization following (Meštrović et al., 2015) and the rule descriptions might provide an accurate capture of native speaker intuition.

THE END

References

- Zorka Kašić. 2014. Opšta lingvistika 2 (Fonologija). Lecture Materials, Faculty of Philosophy, University of Belgrade.
- Ana Meštrović, Sanda Martinčić-Ipšić, Mihaela Matešić. 2015. Postupak automatskoga slogovanja temeljem načela najvećega pristupa i statistika slogova za hrvatski jezik. Govor, 32:3–34.
- Živojin Stanojčić and Ljubomir Popović. 2005. Gramatika srpskoga jezika. Zavod za udžbenike i nastavna sredstva Beograd.
- Miloš Utvić. 2011. Annotating the Corpus of Contemporary Serbian. INFOtheca, 12(2):36a–37a.
- Draga Zec. 2000. O strukturi sloga u srpskom jeziku. Južnoslovenski filolog, 56(1-2):435–448.