Gradient Word-Edge Statistics Influence Syllable Segmentation Judgements

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HILS 2024

Motivation

- How are word-medial syllable boundaries learned?
- Simplifying assumption in previous work: boundaries from by Maximum Onset Principle.

Empirical data: variation and additional influences.

Word segmentation: sensitivity to statistics

Is syllabification sensitive to gradient, joint lexical statistics from word edges?

Maximum Onset Principle(MOP)

- Word-medial syllable boundary placement to yield longest possible legal onset (Kahn 1976)
- kaep.stən, not kaeps.tən

Where are syllable boundaries?

- Variable and non-MOP medial syllable boundary judgements:
  - Polish (Rubach & Booij 1990) , French (Content et al. 2001), Irish (Chiosain et al. 2012), Czech(Šturm 2018), English (Eddington et al. 2013)
- Eddington et al. (2013):
  - ~5,000 English lexical items
  - Each presented to ~25 participants
  - Forced choice syllabification judgement

Joint Word Edge Score

- Frequency estimates from CMU Pronunciation Dictionary

P(Onset): estimated from word-initial

P(Coda): estimated from word-final

JointWordEdgeScore of a syllabification: P(Onset) × P(Coda)

JointWordEdgeScore of kaep.stən = P(Onset = st) × P(Coda = p)

- Normalized for each lexical item
- Accounts for coda

Hypothesis

- Assuming a logistic regression model for further analyzing Eddington et al. (2013)'s experimental data.
- Including known predictors of syllabification
- If English speakers' syllable boundary representations are sensitive to joint word-edge statistics, then:
  - Including the joint word-edge statistics predictor will significantly improve model fit

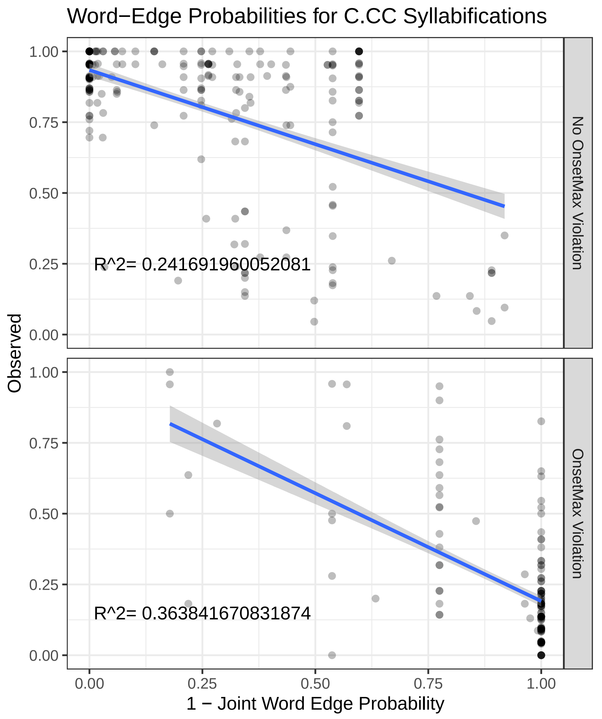
Results: Model Comparison

Model Predictors	Log Likelihood	BIC	ΔBIC
Morph, Stress, OnsetMax	-51133.3	102300.9	1525.1
Morph, Stress, OnsetMax, JointWordEdgeScore	-50365.01	100775.8	0

Table: Model comparison of multinomial regression with and without the inclusion of word-edge statistics (the JointWordEdgeScore predictor).

Bayes Factor of > 100: decisive evidence for JointWordEdgeScore model

Results: Joint Word Edge Score Distribution



- Each point: the C.CC syllabification option for one lexical item (with 3 medial consonants).
- Vertical: how often participants chose this syllabification response. Horizontal: normalized Joint Word Edge Score of the candidate.
- Top: candidates obeying MOP

Discussion

- Supports the hypothesis that joint word-initial and word-final statistics influence English word-medial syllabification
- Similar results found for word-initial statistics in Czech: Šturm (2018)
- Possible implications for syllable representations and learning:
  - Do statistics at word boundaries bootstrap learning of word-medial syllable boundaries?
  - Are some word-medial syllable boundaries gradient?
- More implicit measures of speakers' word-medial syllable boundaries?
- Correlation between MOP and lexical statistics?
- Incorporating joint word edge scores in models of syllable segmentation learning?

Conclusion

- Simple measure of scoring syllabification based on word-initial and word-final lexical statistics
- Model comparison shows English speakers' syllabifications partly explained by joint onset, coda lexical statistics, beyond MOP

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