

Contrast maintenance effects in Norwegian retroflexion

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Norwegian retroflexes

- In Urban East Norwegian (UEN), a laminal coronal series /t d n s/ contrasts with a retroflex series /ʈ ɖ ŋ ʂ/
 - /kat/ 'cat' - /katʃ/ 'map'
 - /bo:d/ 'boring' - /bo:ɖ/ a man's name
 - /tæ:n/ 'yard' - /tæ:ŋ/ 'gymnastics'
 - /ma:s/ 'nagging' - /ma:ʂ/ 'Mars'

Initial contrast

- In initial position, there is a laminal/retroflex contrast only for /s - ʂ/ before a vowel:
- /sɔ:/ 'saw; so; sow' - /ʂɔ:/ 'exhibition'
- /sæ:r/ 'special' - /ʂæ:r/ 'cut; sheer; skerry'
- /sɛ:/ 'see' - /ʂɛ:/ 'happen; spoon'
- Before a consonant, /s - ʂ/ do not contrast:
- /spɔ:/ 'predict' - */ʂp-/
- /stæ:r/ 'starling' - */ʂt-/
- /skɑ:p/ 'closet; create' - */ʂk-/

Norwegian retroflexion

- Retroflexes can also be derived across morpheme boundaries
- When a morpheme ends in /-r/, and the following morpheme begins with /t d n s/, the sequence surfaces as /t̪ d̪ n̪ s̪/
 - /vɔ:r-tæjn/ > /vɔ:-t̪æjn/ 'spring sign'
 - /vɔ:r-da:g/ > /vɔ:-d̪a:g/ 'spring day'
 - /vɔ:r-nat/ > /vɔ:-n̪at/ 'spring night'
 - /vɔ:r-su:r/ > /vɔ:-s̪u:r/ 'spring sun'
 - /vɔ:r-spiɫ/ > /vɔ:-s̪piɫ/ 'spring games'
 - /vɔ:r-stœ:v/ > /vɔ:-s̪t̪œ:v/ 'spring dust'
 - /vɔ:r-sku:/ > /vɔ:-s̪ku:/ 'spring shoes'

Loss of contrast

- Under this condition, the contrast between initial /sV-/ and /ɣV-/ is lost:
- /sV-/, /ɣV-/ > /ɣV-/
- /ʊɔːr-sin/ > /ʊɔː-ɣin/ ‘spring mind’
- /ʊɔːr-ɣin/ > /ʊɔː-ɣin/ ‘spring shine’
- Before a consonant, no contrast is lost
- /sC-/ > /ɣC-/

Contrast maintenance

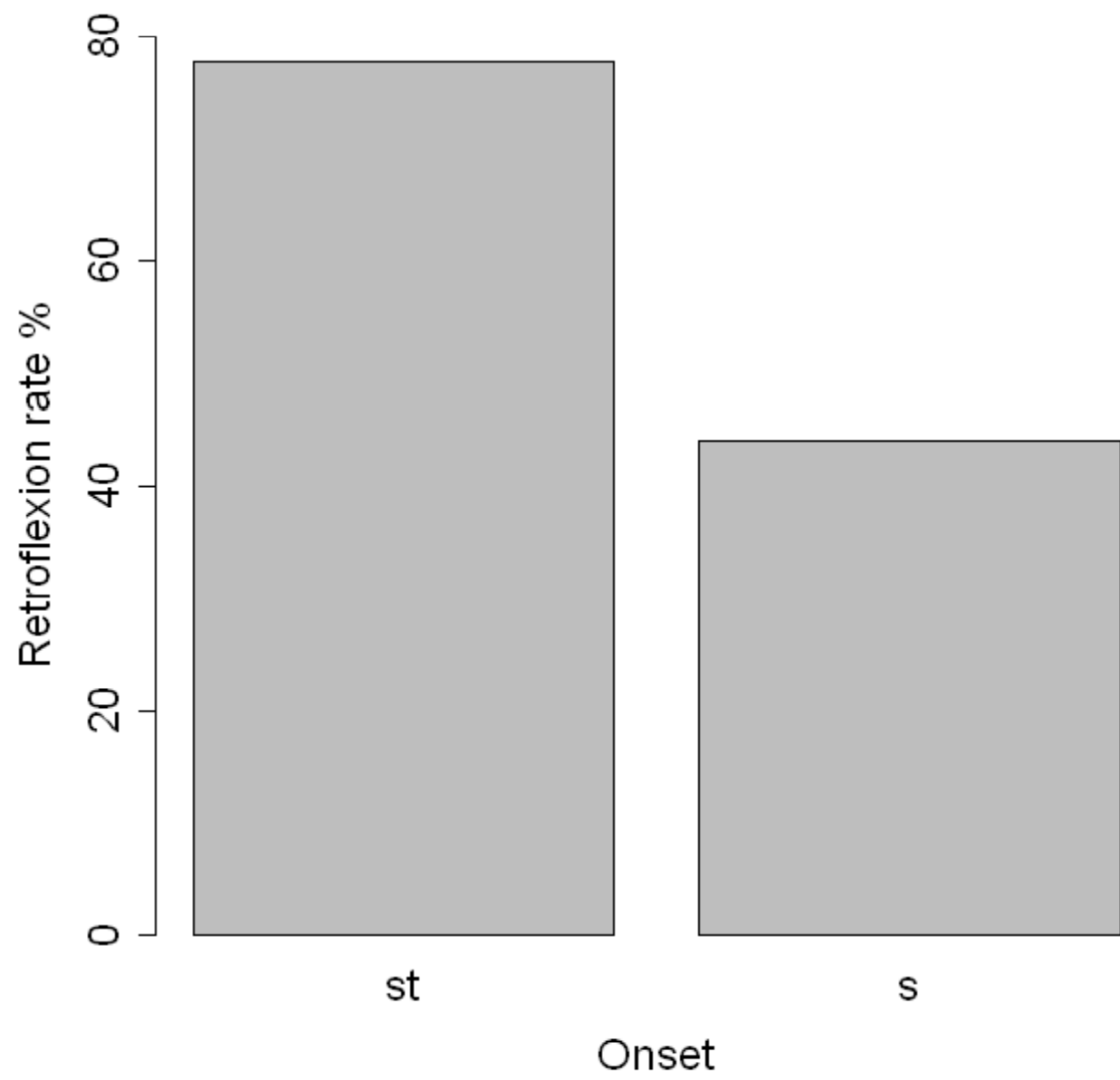
- Phonological rules are often inhibited when they would result in a loss of contrast (Kenstowicz 2005, Ichimura 2006)
- Lenition generally occurs only when no neutralization of contrast would ensue (Gurevich 2004)
- Vowels are less reduced in words that contrast with similar words (Wright 2003, Munson & Solomon 2004)

Contrast maintenance in UEN?

- Hypothesis:
- Retroflexion is inhibited in /sV-/, where retroflexion neutralizes a contrast, compared to /sC-/, where no contrast is neutralized
- In the literature:
- Retroflexion is categorical, and not affected by grammatical conditions (Eliasson 1986, Kristoffersen 2000, Torp 2007)

Experiment 1

- 10 UEN subjects
- Read nominal compounds *bemmer-s...*, where *bemmer* is a nonce word
- The s-words were 5 high frequent monosyllabic nouns in /sV-/ and 5 in /st-/
- 6 instances of each compound in a text. Each text read 4 times.
- 2416 items analyzed



Statistical analysis

- Linear mixed effects model
- Random effects: Subject, Word
- Fixed effects:
- Block (when in the experiment the subject read the text frame)
- Position (the position of the compound in the text frame)
- Frequency (log frequency of the s-word)
- Onset (/sV-/ vs. /sC-/)

Results

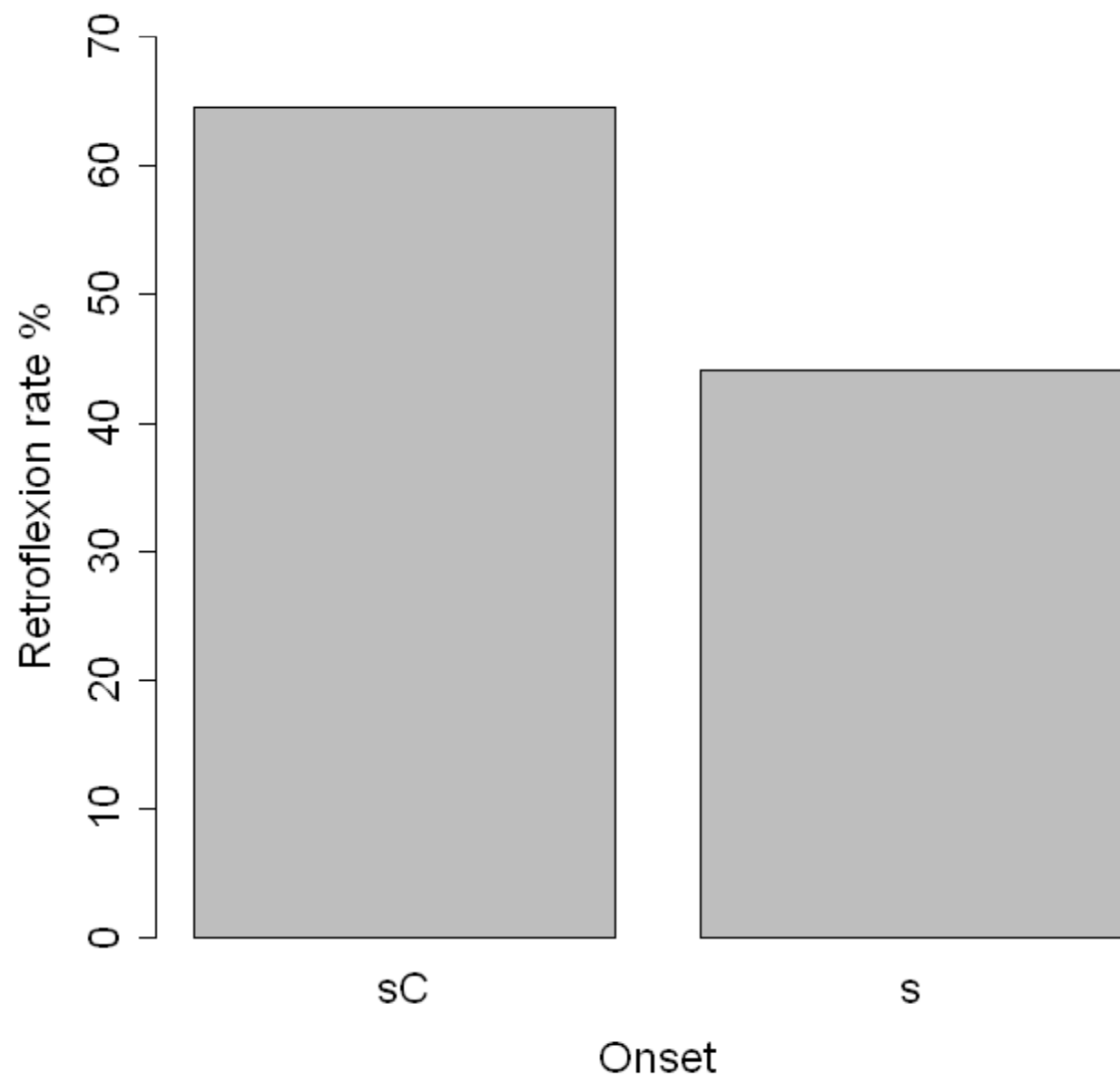
- Likelihood ratio test:
- Block $p < .001$ ***
- Position $p < .001$ ***
- Frequency $p > 0.45$
- Onset $p < .001$ ***

Novel words

- Does the same effect of /sV-/ vs. /sC-/ appear for novel words?

Experiment 2

- Nominal compounds *sommer-s...*, where *sommer* = 'summer'
- *s*-word a monosyllabic nonce word in /sV/, /stV/, /skV/
- 3378 items analyzed



- Block $p < .001$ ***
- Position $p < .001$ ***
- Onset $p < .001$ ***

Origin

- Hypothesis confirmed:
- /sV-/ is less likely to undergo retroflexion than /sC-/
/sC-/
- Why?
- Will entertain a naturalistic cause-effect explanation, and not a teleological explanation ('in order to maintain contrast')

Lexical neighborhood

- The lexical neighborhood of a word = other words of the lexicon that are phonologically similar to that word
- The main effect of lexical neighborhood is located at the beginning of a word (Vitevitch 2002a)
- A retroflexed [ʂV-] token has a big neighborhood
- It is very similar to existing words in /ʂV-/, /ɕV-/, and /sV-/
/sV-/
- Retroflexed [ʂC-] tokens have a smaller neighborhood
- They are similar to /sC-/ words (which they belong to), but no words in /ʂC-/ or /ɕC-/ exist

Lexical neighborhood

- Words with greater neighborhoods are more likely to be misidentified as one of their neighbors (Vitevitch 2002b, 2002c)
- And they are more likely to not be identified with any word at all (Luce & Pisoni 1998, Vitevitch & Luce 1999, Dirks et al. 2001)
- As a result, retroflexed [ʂV-] tokens are more likely not to be identified to their correct /sV-/ word category than retroflexed [ʂC-] tokens are

Phonotactic probability

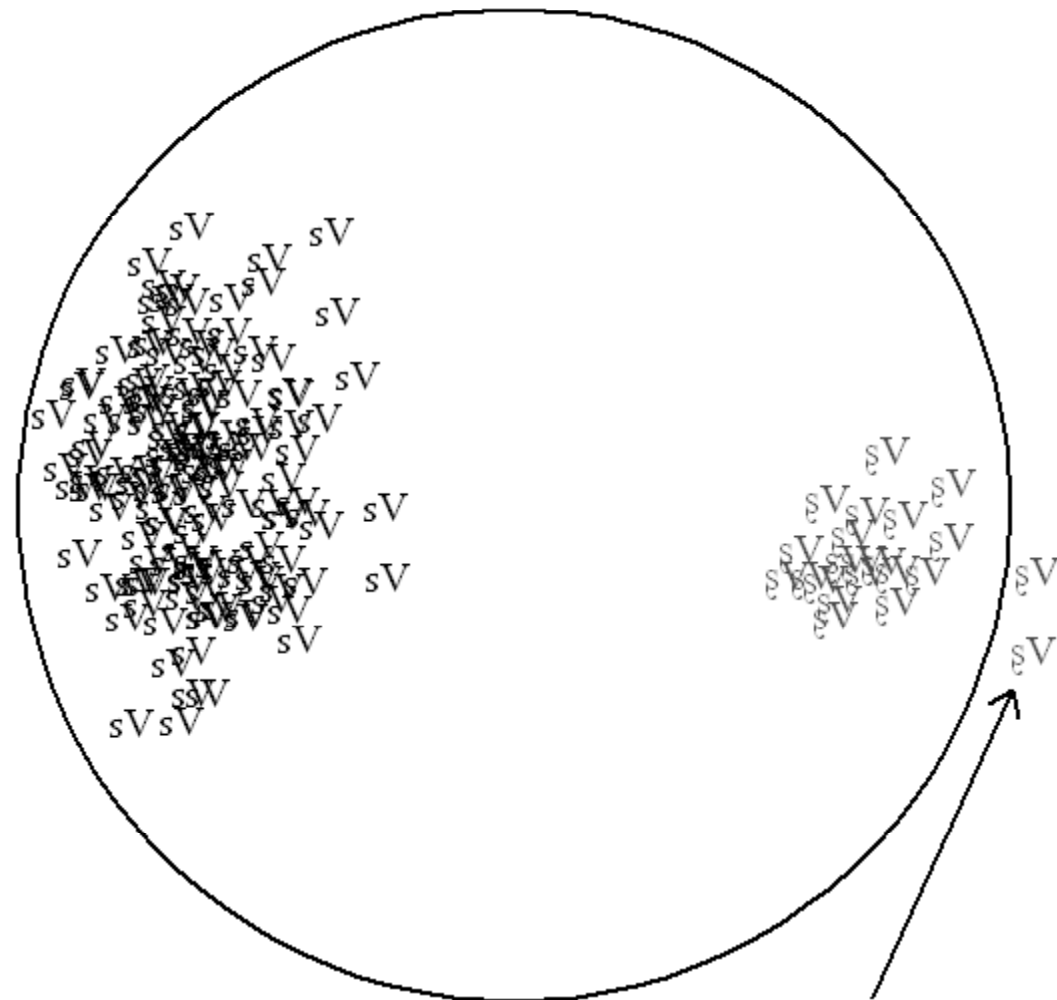
- Phonotactic probability = the probability of a certain phonotactic sequence in the lexicon
- [ʃV-] has a high phonotactic probability (/ʃV-/ words & retroflexed tokens of /sV-/ words)
- [ʃC-] has a low phonotactic probability (only retroflexed tokens of /sC-/ words)

Phonotactic probability

- Non-words with a high phonotactic probability are more likely to be categorized as real words (Vitevitch & Luce 1999)
- The retroflexed tokens of /sɛŋ/ 'bed' and /stæjn/ 'stone' are [ʂɛŋ] and [ʂtæjn]
- Neither /ʂɛŋ/ nor /ʂtæjn/ are UEN words
- But /ʂɛŋ/ has a high phonotactic probability, /ʂtæjn/ does not
- Speakers are therefore more likely to err and categorize a token [ʂɛŋ] as a word /ʂɛŋ/ than to categorize a token [ʂtæjn] as a word /ʂtæjn/

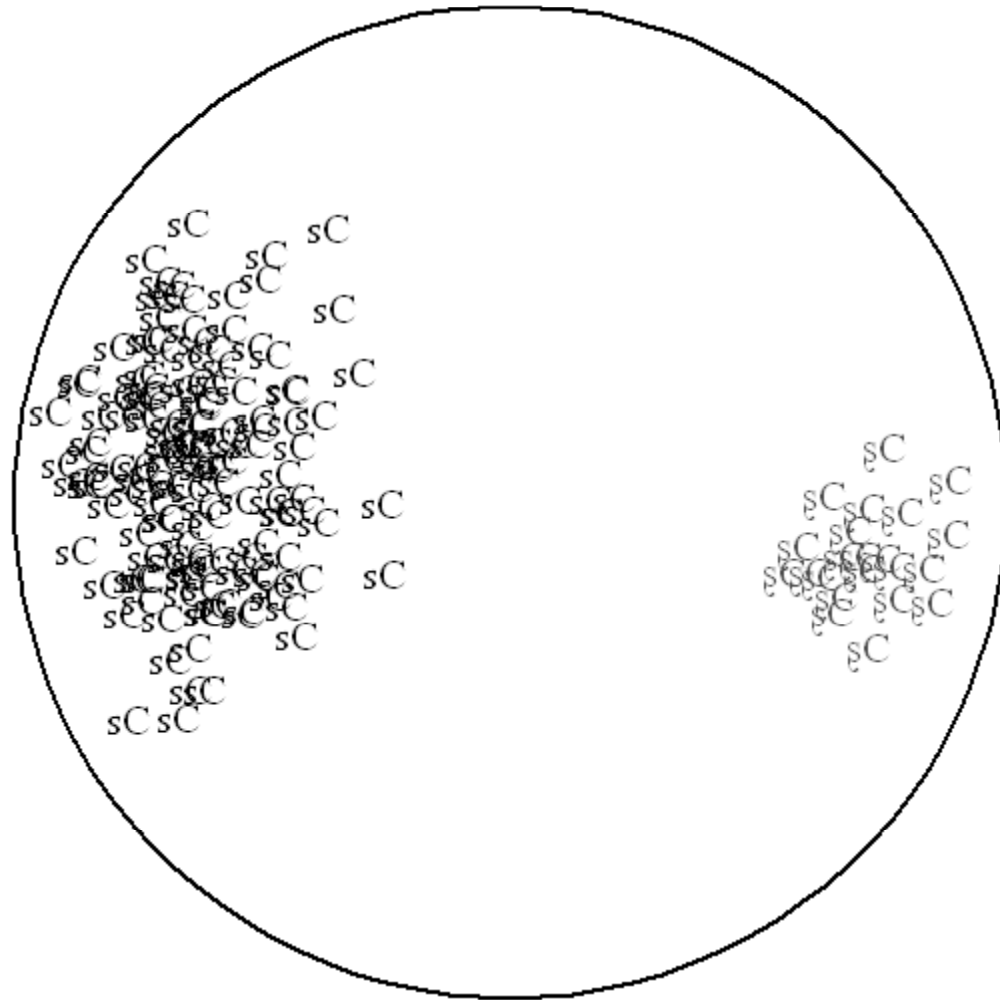
- The effect of these two factors (neighborhood & phonotactic probability) are the same:
- There is a higher chance that a retroflexed [ʂV-] token is not correctly identified than for a retroflexed [ʂC-] token
- This effect can be illustrated within an exemplar model

Category: /sV/-word



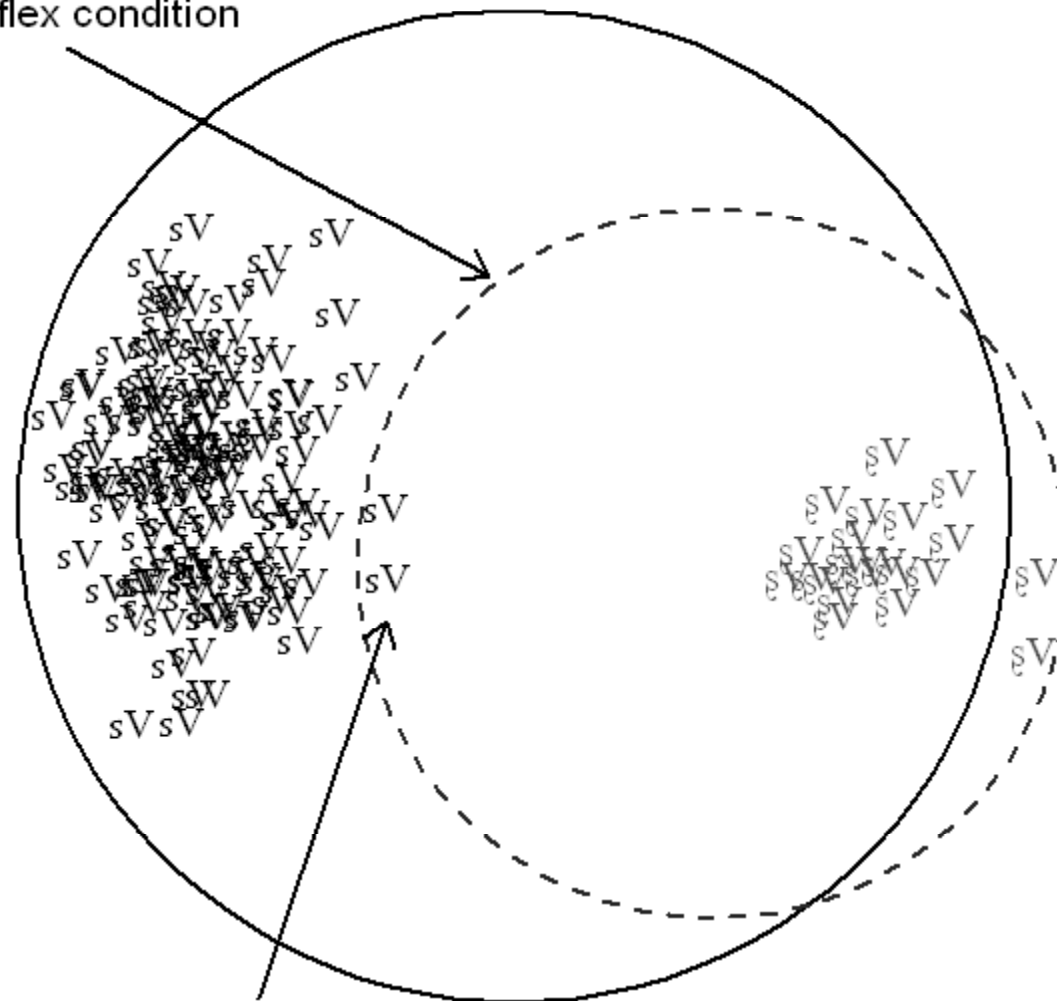
Tokens not identified

Category: /sC/-word



Category: /sV/-word

Retroflex condition

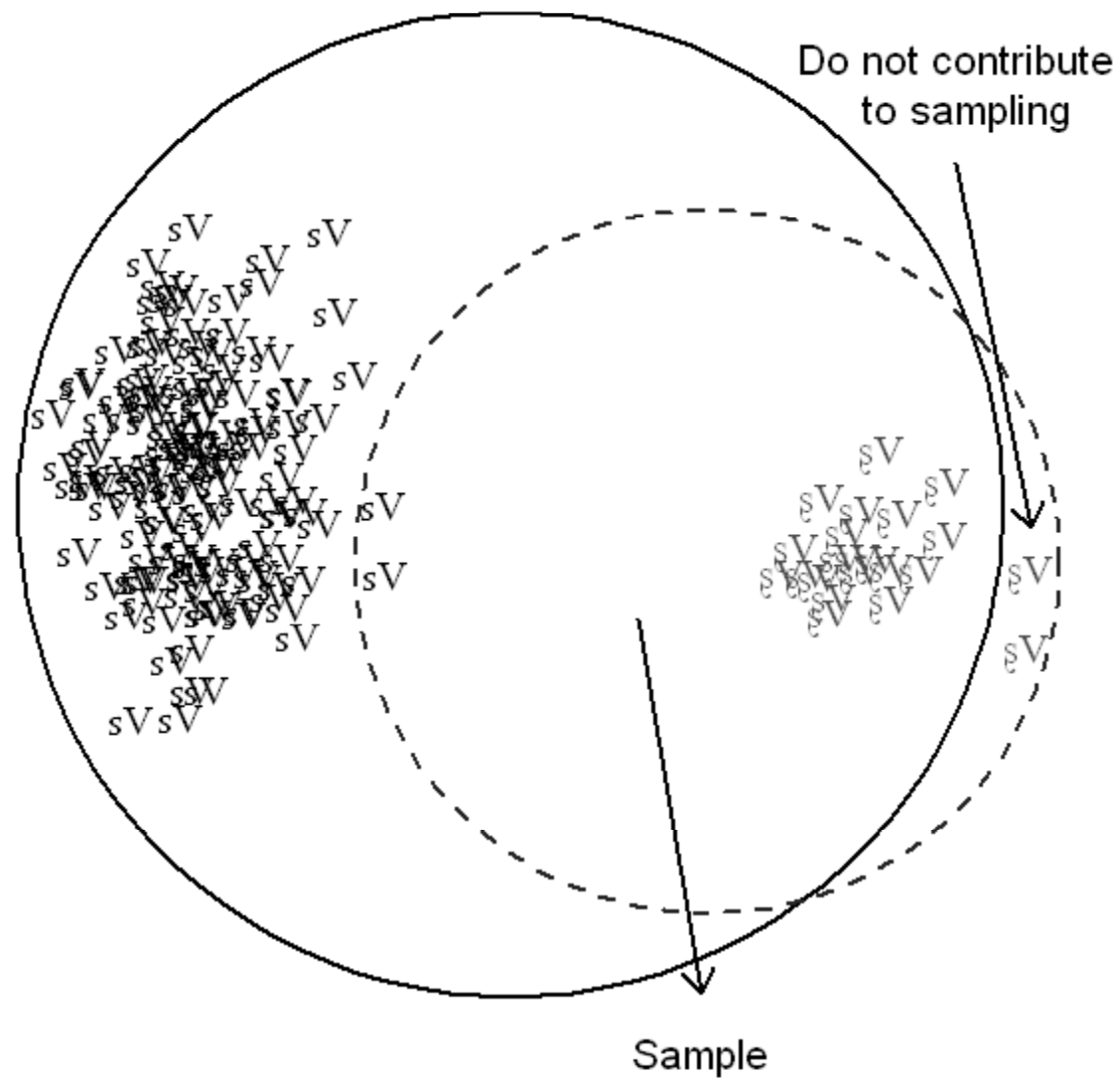


Hyperarticulated tokens

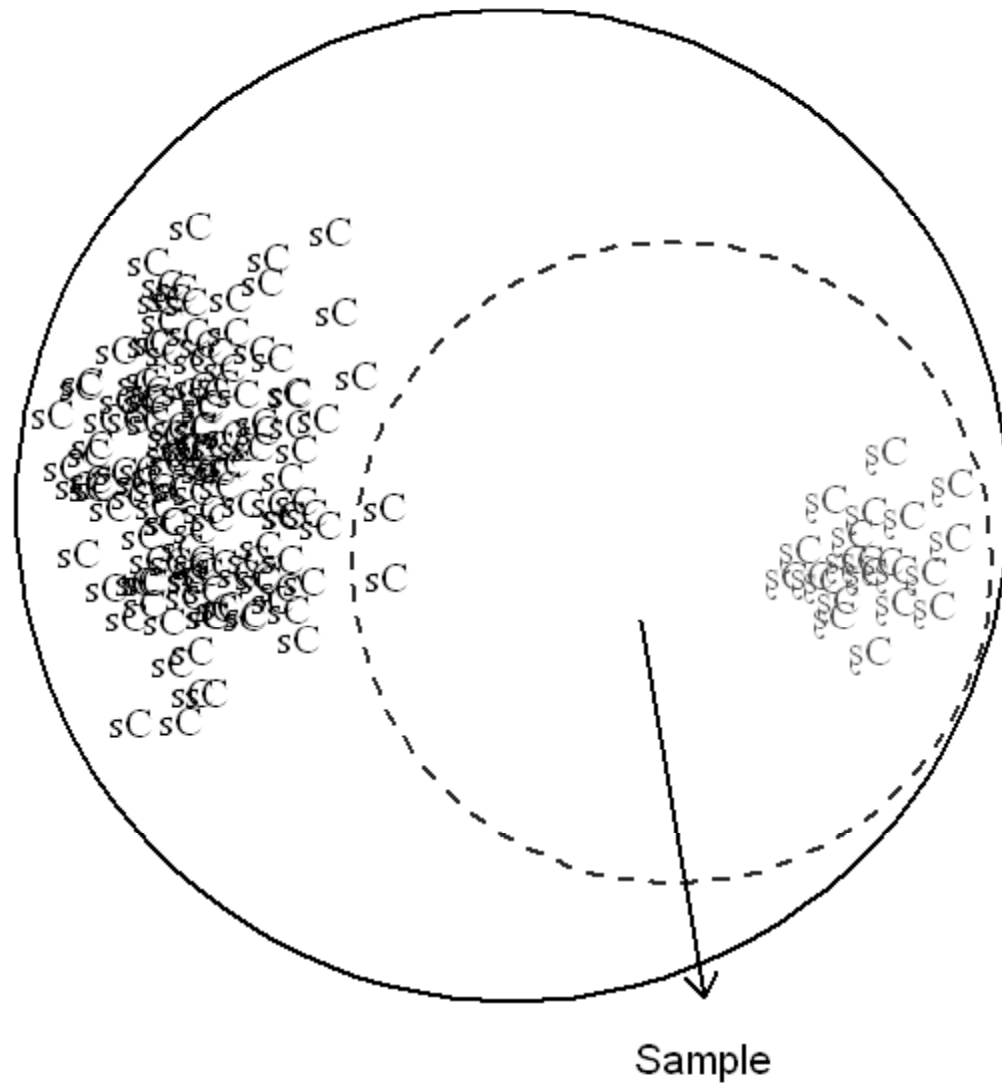
Production

- Production in the exemplar model:
- For category /x/, sample randomly from its identified tokens (Pierrehumbert 2002)
- UEN 'retroflex rule' = sample from the retroflex condition of the category

Category: /sV/-word



Category: /sC/-word



- There are more retroflex [ʂC-] tokens contributing to the sampling of a /sC-/ word in the retroflex condition than there are retroflex [ʂV-] tokens contributing for a /sV-/ word
- The likelihood of producing a retroflex token in the retroflex condition is therefore higher for /sC-/ than for /sV-/
- Every perception/production loop adds some increased chance of /sV-/ and /sC-/ being different ⇒ a significant difference after numerous loops

Work to be done

- Calculate the lexical neighborhood and phonotactic probability of every item in experiment 1 & 2
- Add those values to the model
- See if they are significant predictors of retroflexion
- And if they cancel out the predicting value of the 'Onset' effect

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