Phonological contrastiveness and its consequences

- Sounds separated by even one minimal pair are considered contrastive phonemes. But what if their distribution is mostly predictable, and nearly complementary?
- Do speakers and listeners treat weak, marginal contrasts differently from others?
- Characteristics of marginal contrast
  - Near or partial predictability, phonetic variability, frequency imbalance, scarcity of minimal pairs, phonetic overlap (Hall 2013, Nadue & Renwick 2016)
- Functional load
  - How much neutralization would result from the loss of a contrast? (Hockett 1966)
- More minimal pairs = higher functional load
- Language change over time
  - Contrasts with low functional load are more likely to merge (Wedel et al. 2013)

The Romanian vowel system

is unique among the Romance languages, in particular for its phonemic central vowels and rare diphthongs (Chitorean 2002)

Marginal contrast in Romanian (Renwick 2014)

- Central /i, /  are historical allophones in near-complementary distribution
- /i/: Typically (90%) found in pre-nasal, stressed contexts; never post-tonic ['kimip]' 'field' ['лина'] 'wool (def.)', ['вина'] 'vein (def.)'
- /i/: Usually unstressed, word-final (46%); has a large morphological role ['касъ'] 'house' ['съ}ta'] 'hundred' ['пъtts'] 'bed (dim.)'
- Few minimal pairs exist
  - /riv/ 'river' [raw] 'bad'
  - /tr/ 'I thrust' [var] 'cousin'
  - /tsi/ 'sea mackerels' [tsx] 'lands (n.)'
- Both /i, / have low type frequency, suggesting low functional load
- It was hypothesized that the phonologically weak contrast between /i, / was subject to phonetic merger; however, studies of production and perception in laboratory speech found little evidence for this.

Research Question:

How is the phonologically weak contrast between /i, / realized in continuous speech?

Data and Methods

Acoustics of 7 monophthongs compared across laboratory vs. broadcast speech.

Laboratory speech (Renwick 2014)

- Stressed and unstressed vowels; target words in a frame sentence with 3 repetitions
- 18 native speakers (3 male)
- Formant values (F1, F2) extracted at midpoint; hand-checked
- 5,261 tokens (2,396 central vowels)

Broadcast speech (Vasilescu, Vieru & Lamel 2014)

- Mixture of prepared speech from news shows, and spontaneous debates from TV channel Antena, in the standard Southern dialect
- 7 hours, 86 speakers (male & female; adult)
- Segment boundaries automatically aligned
- Formant values extracted at midpoint (Gendrot & Adda-Decker 2005)
- Acoustic filtering of data
- Tokens with voicing in < 40% of vowel were excluded
- Each token’s Mahalanobis distance (Mahalanobis 1936) was calculated relative to a speaker- and vowel-specific centroid; tokens with high distance (based on a χ² distribution) were excluded as outliers
- Vowel tokens analyzed: 104,456 (11,006 central vowels)
- Vowel’s functional load calculated from 9,032 unique words (Hall et al. 2015)

Normalization and analysis

Formant values normalized by speaker (Lobanov 1971)
- Acoustic overlap in standard deviations of F1 calculated among adjacent vowel pairs (Fougeron & Audibert 2011)

Results: vowel frequency and functional load in broadcast speech

- [i, x] appear in many function words, but are rare, with complementary distributions

Results: acoustics of lab speech vs. broadcast speech

Discussion

- The contrast between [i, x] is severely diminished in continuous speech
- [i] is lower (higher F1) in broadcast than in laboratory speech
- Greater central vowel overlap occurs in broadcast speech
- Centralization is not a byproduct of reduction (via shortening)
- Functional load of the /i, / contrast is lowest of all vowel pairs
- Speakers' cognitive representations of /i, / may not be separable from context
- Merger is strongest pre-nasally, where /i/ is strongly conditioned
- Underlying vowel quality highly conditioned by morphology and phonology
- Future perceptual studies will indicate listener sensitivity to vowel quality, independent of phonological context

References