“Segmental Anchoring” of F0 Under Changes in Speech Rate: Evidence from Russian

Introduction

- **Intonation contour** is a sequence of phonological **level tones** such as Hs and Ls, occurring at specific points in the segmental string.
- **F0 movements** such as rises and falls **per se** are merely transitions from their beginning point to its ending point.

- Two views are in a controversy in intonational research
  - **Configuration view**: Intonational primitive is movement or “configuration”
  - **Level view**: Intonational primitive is a **level tone**.

- Two views entail different predictions as to variability of F0
  - **Configuration view**: Duration and/or slope of F0 should be constant.
  - **Level view**: Alignment and F0 level of tonal targets (= the beginning and ending points of F0 movement) should be constant.

- **“Σημαστική Διαχρονίκηση” (Arvaniti et al. 1998)**

  - The beginning and ending points of F0 rise (related to prenuclear pitch accent) in Greek are consistently anchored at the specific points in the segmental string.
    - **The beginning point (L target)**: aligns just before the onset of the accented syllable
    - **The ending point (H target)**: aligns at the onset of the vowel following the accented syllable
  - The rise **duration and slope** are **not constant** but are depended on the duration of the segments that accompany the F0 rise.

- Phenomenon of “Segmental anchoring” is argued to be evidence for the “**level view**”, because it shows:
  - The alignment and F0 level of tonal targets (= phonetic realization of level tones) are constant.
  - The duration and slope of F0 movement (which are regarded as the constant properties in the configuration view) are not constant but are determined by the alignment and F0 level of tonal targets.

Experiment

- **Basic approach of the experiment:**
  - Measurement of 1) the rise duration, 2) the alignment of the L and H target of an English rising prenuclear accent is unaffected by changes in segmental duration brought about by modifications of speech rate
  - The duration and slope of the accents become shorter and steeper as rate increases.

- **Dutch**: (Ladd et al. 2000)
  - The L target of rising prenuclear accent in Dutch consistently aligns at the onset of the accented syllable.
  - The H seems to align with the end of the accented syllable, depending on whether the vowel of the accented syllable is phonologically long or short: it aligns late in the accented vowel when the vowel is long and midway in the following consonant when the vowel is short.

- **Is there segmental anchoring in Russian, too??**

Materials

- **Twenty sentences with the Subject-Verb-Object or Adverbial syntactic structure**
- A typical sentence: Románova guljála v górode (Romanova was walking in the city)
- Measurement of the accent on the first word.

Speakers

- Seven native speakers of Russian, four females and three males.
Results

Rise duration increases as speech rate slows.

Rise duration is correlated with duration of the accented syllable.

Rise duration is not constant
- It increases as speech rate slows (as the syllable duration increases)

Alignment of L is relatively constant
- L aligns just before the onset of the accented syllable

Three speakers produced larger excursion as rate slows:
Is slope constant??

Alignment H is relatively constant
- H aligns somewhere in the onset consonant of the following syllable

If the slope is constant, the F0 excursion should be greater as rate decreases, because there would be more time between L and H.

If the slope is not constant, there should be no effect of speech rate on the excursion.

Five speakers showed a significant correlation between rise duration and excursion:
Is slope constant??

Alignment L is relatively constant
- Except for one speaker:
  - L aligns just before the onset of the accented syllable
1. The rise duration was not constant but it increases as rate slows.

2. Both the beginning and the end of the rise were anchored with specific points in the segmental string, regardless the changes in speech rate.

3. For some speakers, rate had those effects on F0 excursion which suggest that the slope is constant.

Conclusion

- The existence of “segmental anchoring” was confirmed in Russian. (The results of the study by Ladd et al. (1999) for English were partially replicated.)

- The results also seemed to support the view that a given type of pitch accent has the constant slope.