Segmental anchoring in the context of vocalic deletion

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Introduction

• Two different levels of linking: phonological association and phonetic alignment, which have a complex relation (Ladd 1983)
• Research on the fine details of alignment has given rise to the Segmental Anchoring Hypothesis whereby tones align in a systematic way with specific segmental landmarks (Arvaniti et al. 1998, 2000)
• These results shed light on the distinction between discrete phonological association and gradient phonetic alignment; the former involves linking pitch accents to prosodic heads and edge tones to boundaries; the latter involves the detailed linking between tones and segments
Introduction

• However, despite the empirical evidence amassed from numerous studies, these distinctions are by no means well understood or uncontroversial.

• There are still different interpretations on the empirical data of how melodic and segmental units are linked.

• Several recent studies have shown variability in the text-tune linking within a dialect or across dialects. This variability has been attributed either to phonetic differences (e.g. Atterer and Ladd 2004; Arvaniti and Garding 2007) or phonological ones (e.g. Face and Prieto 2002; Prieto et al. 2005; Prieto and Torreira 2007).
Northern Greek

• Our case study looks at text-tune linking from a new perspective and offers new data that we hope will contribute to our better understanding
Northern Greek

• Our case study looks at text-tune linking from a new perspective and offers new data that we hope will contribute to our better understanding (or further confusion!)

• Northern Greek (NG) allows us to observe how linking of the H tone of a L*+H pitch accent is resolved when the typical segment it links to is deleted
Standard Modern Greek (SMG)

L*+H: the predominant pitch accent choice for pre-nuclear positions in SMG (Arvaniti et al. 1998; Baltazani 2002; Arvaniti & Baltazani 2005)

• The L*+H is associated with the stressed syllable but has a complex alignment with the segmental string, necessitating two syllables, the stressed and the post-accentual one, for full realization

• Neither the L nor the H align with the stressed syllable
  o L: 5ms before the onset of the stressed syllable
  o H at the beginning of the post-accentual vowel
  o The alignment of these tones has been shown to be stable for Greek (and cross-linguistically)
Example: L*+H in SMG
Northern Greek (NG) V Deletion

- Deletion of unstressed high vowels /i, u/, e.g. /malóni/ → [malón] ‘scolds’ in NG dialects (Topintzi & Baltazani 2012). It does not always apply, and it is gradient, but it is more likely in word-final position (cf. Brazilian Portuguese, Meneses and Albano earlier today).

- Deletion can obliterate the V which the H tone links to.

- Experimental question: Where does the H move to after vowel deletion?

- Different predictions can be made, depending on whether one views the rule which links the H tone to the text as phonological or phonetic.
Hypotheses
SMG phonological association of H

If the H-linking rule is phonological it should refer to a syllable (or a mora). Given that the H in L*+H typically appears at the onset of the first post-accentual vowel, we expect that the rule will make reference to a nucleus left edge:

• Attach the H at the left-edge of first available post-accentual nucleus
  • H1: If the remaining C becomes a coda, link H to the V of the following word (cf. Arvaniti et al. 1998)
  • H2: If the remaining C is syllabic, link H to its left edge
Phonological association

Adapted from Ladd (2008)
Phonological association
Phonological association

H1: Treat C as a coda and move to the nucleus of the next word
Phonological association

H2: Treat C as syllabic and move to onset of available nucleus
Phonetic alignment of H

• If the H-linking rule is phonetic we expect any point in the segmental string can substitute for the lost anchor, without necessary reference to a left edge

• Segmental anchoring hypothesis: we expect stability of the substitute anchoring point
Method
Participants

- Twelve native NG speakers were recorded (5 females, 7 males, 45-70 years old)
- Semi-spontaneous speech (see next slides)
- Recordings took place at the participant’s homes, or at a café where locals frequent (in a separate as much as possible quite room)
Elicitation method

Speakers were asked (by a dialectal speaker) to answer a question regarding a picture they saw

Stimulus: *What is Giannis using to cut the onions?*

Expected response: *Giannis is using a knife to cut the onions.*

We did not use a reading task mainly to avoid interference from SMG
Materials

- 20 sentences, each containing 2 words inducing deletion of the post-accentual vowel (L*+Hdel condition)
- 20 sentences not involving deletion (L*+H condition)
- The test words formed near-minimal pairs, e.g. rubìni – rubìna
- Post-accentual C: 20 sonorants [n, l, r]; 20 obstruents [v, ð, z, ŋ]

<table>
<thead>
<tr>
<th>Condition</th>
<th>Stimulus and expected response</th>
</tr>
</thead>
<tbody>
<tr>
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<td>S: me pçon ðialèji to rubìni i eleni? ‘Who is Eleni choosing the ruby with?’</td>
</tr>
<tr>
<td></td>
<td>R: i eleni ðialèji to rubìni me to jani ‘Eleni is choosing the ruby with John’</td>
</tr>
<tr>
<td>L*+H</td>
<td>S: me pçon ðialèγun ta rubìna ta koritsia? ‘Who are the girls choosing the rubies with?’</td>
</tr>
<tr>
<td></td>
<td>R:ta koritsia ðialèγun ta rubìna me to manoli ‘The girls are choosing the rubies with Manolis’</td>
</tr>
</tbody>
</table>
Materials

• Penultimate stress words ending in –i were chosen for L*+Hdel condition to increase chances of [i] deletion
• We constructed the materials to avoid tonal crowding even after the (possible) deletion, i.e. at least 3 syllables between stresses
• Most tokens were followed by [to] ‘the’ or [me] ‘with’
• Focus away from target words

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Measurements

The alignment of tones in L*+Hdel and L*+H tokens was compared. The test words were manually segmented and labeled.

Measurements:

- Duration of all segments: C0, V0 = stressed syllable; C1, V1 = post-accentual syllable
- Distance (ms) between L and C0 onset
- Distance (ms) between H and V1 onset (L*+H)
- Distance (ms) between H and C1 onset (L*+Hdel)
- Scaling of L and H (normalized through natural log)
- Distance (ms) between L and H
  - Locating the L was not easy; large standard deviation in L measurements—they should be viewed with caution
Example of measurement points:

L*+H

<table>
<thead>
<tr>
<th>ta koritsia</th>
<th>dialogoun</th>
<th>me to Gianni</th>
<th>ta roubinia</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
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<tr>
<td>ovrl</td>
<td>evdi2</td>
<td>evrl</td>
<td>ivd1</td>
</tr>
<tr>
<td>L+H*</td>
<td>L*+H</td>
<td>L*+Hdel</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>C V0 C1 V1</td>
<td>C0 V0 C V</td>
<td>C V0 C</td>
<td></td>
</tr>
</tbody>
</table>
Example of measurement points: L*+Hdel
Results
A lot of discarded data

• We had to discard a lot of data, especially in the L*+Hdel condition
  o Speaker used different pitch accent (mainly L+H*)
    [i elen ḏialèj to rubìn me to jan]
  o Speaker paused after the target word
    [u jabi tu kremið tu kaθarìz mi tu maçèr]
  o Speaker did not delete [i]

• Kept 140 out of 480 tokens of L*+Hdel
• Data not balanced, so we could only perform t-tests
• Nevertheless the differences between the two conditions are clear
Differences in L*+H between SMG and NG

Same targets in both dialects but difference in alignment details (Cf. Atterer and Ladd 2004, Arvaniti and Garding 2007, Prieto et al. 2005)

SMG
L = 5ms before onset C0
H = 10.6ms after onset V1

NG
L = 14ms after onset C0
H = 0.6ms after onset V1
**L*+H vs L*+Hdel in NG**

Significant difference in the alignment of H between L*+H and L*+Hdel (measurement: distance from left edge of V1 or C1)

**NG L*+H**
- L = 12ms after onset C0
- H = 0.6ms after onset V1

**NG L*+Hdel**
- L = 80ms after onset C0
- H = 23ms after onset C1
Variation in H alignment

Greater variability was observed in the H alignment for L*+Hdel.

76% of tokens are at or ±3ms from V1 onset in L*+H. Very stable alignment.
Speaker variation

Significant cross-speaker difference in H alignment for L*+Hdel (F(0.16, 0.42) = 4.151, p = <.001) but not for L*+H.
Scaling

- No difference in L or H scaling between L*+H (mean = 269.12 Hz) and L*+Hdel (mean = 274.14 Hz)
- Deletion does not affect tone scaling
Discussion

• Across languages speakers rely on different tactics to cope with segmental pressure, among which are truncation, undershoot and compression (Ladd 2008)

• In NG, speakers do not employ truncation (=both tones survive) or undershoot (=no difference in scaling was found between L*+H and L*+Hdel)

• Instead they seem to use compression of the pitch accent to cope with the pressure from V deletion:
  o The L-to-H distance in L*+Hdel (149ms, SD=39ms) is shorter than in L*+H (202ms, SD=49ms)
    \[ t(220)=8.036, \ p<.001 \]
Discussion: phonology or phonetics?

Our results give more support to a phonetic linking between tones and segments

1. Cross dialectal use of L*+H (in SMG and NG): In non deletion environments the alignment of L*+H uses the same targets in SMG and NG, albeit with some small timing differences.

→ It is more economical to assume one phonological entity in both dialects which is realized differently in its phonetic details
Discussion: phonology or phonetics?

Our results give more support to a phonetic linking between tones and segments

2. Significant difference in H alignment between L*+H and L*+Hdel:
   - L*+H: the H attaches precisely at the left edge of the V
   - L*+Hdel: the H attaches 1/3 into the C

→ This pattern indicates lack of reference to a left edge as a phonological target, since the anchor differs
Our results give more support to a phonetic linking between tones and segments.

3. Inter-speaker variability

→ Adds to the overall picture of variability, which should not occur for a phonological rule.
Discussion: lack of stability?

• The segmental anchoring hypothesis expresses a regularity empirically observed in many languages—the stability of the segmental landmark. Does the variability uncovered in our Hdel data mean lack of stability?

• We calculated intra-speaker variance homogeneity between the two conditions, which showed no difference in dispersion (L*+H mean = 22ms, SD=9.950; L*+Hdel mean = 25ms, SD=19.7; t(6)=-.382, p=.715)

• Despite great cross-speaker variability, individual speakers show as stable an alignment of H in L*+Hdel as in L*+H
Discussion: lack of stability?

- This result suggests that segmental anchoring is operative, but that different speakers employ different strategies to cope with the vowel-anchor loss.
- Variability in alignment of H between speakers has also been shown for L*+H in SMG, where segment type affected alignment somewhat differently for each speaker (Arvaniti et al. 1998), but it is more pronounced in our data.
- We postulate a connection between high cross-speaker variability and the variability in [i] deletion application, which prevents the existence of a uniform phonetic rule.
  - How can we test this? An articulatory study might provide a solution (?)
Future directions

• The L*+Hdel occurred word-finally. There might be a confound of pressure from the upcoming word boundary
  o We need to study the L*+Hdel behavior also away from word boundaries
• V deletion is a gradient process ranging from V retention to complete deletion, with intermediate stages of partial deletion, i.e. vowel shortening (Topintzi & Baltazani 2012)
  o Examine the L*+Hdel behavior in cases of partial V deletion
• Complete V deletion often creates C clusters in NG
  o Examine the L*+Hdel behavior with C clusters
Conclusions

- Our results have given us evidence in support of a phonetic rule regulating the linking of the H tone to the segmental string since differences between deletion and non-deletion environments are continuous, not discrete.
- The shift of the anchor point in deletion environments seems to be due to a compression strategy employed by the speakers to cope with the loss of the vowel.
- Cross speaker variability was found and needs to be further investigated.
Invitation

Suggestions are very welcome indeed!
Thank you
Acknowledgments

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References


