The interaction of tone and vowel quality in Optimality Theory: A study of Moscow Russian vowel reduction

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Abstract

Although the interrelation of tone and segmental quality is typologically unusual, cases of vowel-tone interaction have been reported in the literature. The present paper argues that tone can interact directly with vowel quality without mediating factors such as syllable structure or duration. The basic assumption is that tonally prominent units co-occur with prominent segments. In terms of Optimality Theory, this generalisation is expressed by the family of markedness constraints *H/≤a, which are derived by harmonic alignment of two natural linguistic scales, the tonal scale and the sonority scale. The proposed constraints are used in the analysis of vowel neutralisations found in immediately pretonic positions in the Moscow variety of Standard Russian. A characteristic trait of standard Russian is that it exhibits two-pattern vowel reduction: moderate reduction is found in immediately pretonic positions, while extreme reduction is found in atonic positions. Previous accounts have suggested that different degrees of reduction are due to iambic foot structure. This paper argues that such an approach is flawed and develops an OT analysis, which is based on the insight originally expressed by Bethin (2006) that vocalic neutralisations are driven by the High tone spread from the stressed syllable.
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1. Introduction

The relation between tone and other phonological units has been well documented in the literature. Tone can interact with stress placement (de Lacy, 2002b), duration (Zhang, 2002), and syllable structure (Gordon, 2006). In addition, the literature is replete with examples of the interrelation between tone and the laryngeal properties of consonants (Hombert, 1978; Bradshaw, 1999 and others). In contrast, the interaction between tone and vowel quality is not widely attested. Nevertheless, there are languages which exhibit tone-driven vowel alternations. For instance, High tone is reported to have a raising effect on vowels in Fuzhou (Yip, 1980; Jiang-King, 1999; Myers and Tsay, 2003), Foochow (Chen and Norman, 1965) and Lahu (Matisoff, 1973). Similarly, Becker and Jurgec (in press) report a synchronic interaction of tone with vowel quality in Slovenian, where High tone co-occurs with tense vowels and low tone co-occurs with lax vowels. The opposite pattern is also attested. In Shuijingping Mang, lower tones induce vowel raising (Mortensen, 2013). High tone is correlated with low vowels in Ngizim, where the vowel [a] in the first syllable of verbs is predictably associated with High tone (Schuh, 1971).

Some authors explicitly deny a possibility of a systematic phonological interrelation between tone and vowel quality (*cf.* Schuh, 1978:224–225; Fox, 2000:233; de Lacy, 2007:299). It has been argued that in many cases of tone–vowel

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interactions, tone affects vocalic quality indirectly through syllable structure or duration (Jiang-King, 1999; Gussenhoven and Driessen, 2004). The present paper suggests that tone can interact directly with vowel quality without the mediating factors such as syllable structure or duration. I propose that there is a family of markedness constraints relating tone with vowel sonority. These constraints are derived by combining two prominence scales: the tonal scale and the sonority scale.

The assumption that tone can interact with vowel quality is substantiated by the analysis of vowel neutralisations in the Moscow variety of Standard Russian.[1] The characteristic trait of standard Russian is that it exhibits two-pattern vowel reduction: reduction to corner vowels is found in immediately pretonic positions and centralisation to schwa in atonic contexts (Avanesov, 1984).[2] The phenomenon of Russian vowel reduction has been extensively studied within most phonological theories which evolved in the past century. In the framework of Optimality Theory (Prince and Smolensky, 1993; McCarthy and Prince, 1995), recent studies include van Oostendorp (1995), Crosswhite (2001), de Lacy (2006), Iosad (2012). Though these models have provided a number of descriptive and theoretical insights, they do not account for all reduction patterns found in Russian. The present paper proposes a novel account, in which a different mechanism is argued to be responsible for vowel reduction found in immediately pretonic positions. The proposal is based on the insight of Bethin (2006) that pretonic vocalic neutralisations are driven by the presence of the High tone in dissimilative dialects of Russian. This idea is formalised in terms of Optimality Theory and the analysis is extended to account for Moscow Contemporary Standard Russian vowel neutralisations.

The paper is organised as follows. First, basic theoretical assumptions are presented in section 2. The generalisation related to the interaction of tone with vowel quality is expressed as a family of markedness constraints the framework of Optimality Theory (OT, hereafter). Section 3 demonstrates how these constraints derive vowel alternations found in immediately pretonic positions in Russian. In particular, it is argued that the reduction of /o/ to [a] is driven by the High tone. Finally, the main results are summarised in section 4.

2. Theory

Typically, phonological tone is realised phonetically by pitch. However, it has been pointed out in the literature that there are other conceivable ways to express phonological tone (Lockwood, 1983; van der Hulst, 1999:73ff.). Just as phonological accent can be manifested by different phonetic means, underlying tone can have different phonetic exponents. There is evidence that tone can be expressed by prolonged duration, with or without phonetic pitch contour (Lockwood, 1983; Bethin, 2006). Bethin (2006) reports tone-induced lengthening of pretonic vowels in East Slavic dialects. In these dialects, vowels lengthen in positions preceding stressed syllables. Phonetic measurements demonstrate that, while vowels in atonic positions are considerably shorter than stressed vowels, vowels in immediately pretonic positions often exceed stressed vowels in length.[3] Some examples from the Archaic Vladimir-Volga Basin dialects are shown in (1), reproduced from Bethin (2006:130). Note that length is not contrastive in these dialects and the symbol *V:* shows phonetic duration.

(1) golova [gələ'va:] 'head'
      rukava [rəka'va:] 'sleeves'
      daleko [dələ'ko:] 'far away'
      ogurtsi [ugu:r'tsɨ:] 'cucumbers'

Bethin (2006) argues that pretonic lengthening found in East Slavic dialects reflects an underlying tonal contour. As dynamic tones are better cued by long vowels, the vowel in immediately pretonic position is lengthened to accommodate a pitch rise, schematically shown in (2). Phonetically, there is a rising-falling or a falling pitch contour, distributed over the stressed and the immediately pretonic syllable, with a prominence peak occurring on the pretonic syllable.

(2) LH L LH L

     C V 'C V ⇒ C V: 'C V

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[1] In this paper, the term vowel neutralisation refers to the reduction in the number of vocalic contrasts found in immediately pretonic positions. Vowel reduction denotes both the centralisation to [ə] in atonic positions and the neutralisations occuring in immediately pretonic positions.

[2] The term 'pretonic' refers to positions preceding the stressed syllable, and 'posttonic' designates positions following the stressed syllable. The term 'atonic' indicates positions not immediately preceding the stressed syllable, while 'unstressed' collectively refers to all positions which are not marked for stress.

[3] In Vladimir dialects, relative durations are as follows: initial V – 25%, pretonic V – 105%, stressed V – 100%, final V – 42% (Al'muxamedova and Kul'šaripova, 1980:45, cited from Bethin, 2006:131).