Russian Prosody as a Special Case of the Mobile Stress System in Indo-European Languages

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Redundancy is an element of linguistic systems which constrains variation in features that convey an important function, and which counteract phonological change and preserve the intelligibility of speech. Derivational processes are a means by which dual representational systems may be acquired, particularly in unmarked structures. Highly regular and resistant to phonological change [1,2], Russian adjectival suffixes are typically unstressed and pronounced with phonetic vowel reduction, yet they are perceived to bear pitch accents [3]. This paper proposes that the intersection of phonological and morphological features found in Russian adjectival suffixes (i) forms a dual representational system that preserves word-internal metrical structure, and (ii) sheds light on unexplained features of Russian prosody.

There is currently no theoretical model that can fully explain the prosodic features observed in Russian [4-7]. Scholars agree that Russian prosody is notable for its strong macro-rhythm and inventory of bitonal pitch accents [6,7], yet existing models exclude accentual phrases and edge tones because researchers have found it difficult to reconcile the perception of additional tones on syllables that bear no stress with a traditional understanding of how prominence is marked. Halle's [8] work on stress and accent in Indo-European (IE) languages offers a possible solution based on Idsardi's [9] AM theory. Only one stress may be assigned per Russian word [10], whereas the morphemes are inherently accented [8]. This conflict is resolved in IE languages with mobile stress by means of the LLL edge-marking rule: a L(eft) parenthesis placed to the L(eft) of the L(eftmost) element in the string. Word stress is realized on the syllable that is the word head. This system is illustrated with the word "democratic" (demokratičeskaâ) in Figure 1. Every syllable that could bear stress is marked with * in line 0, and a bracket denotes the onset of a foot. Applying the rule, word stress is calculated (see line 2). While Halle did not study prosody, he notes that word stress is accompanied by a high tone [8,11]. The fact that low tones are assigned to all syllables except the one bearing stress suggests that a salient difference is perceived between high and low tones.

The influence of mobile stress in Russian is seen throughout its morphological and phonological paradigms. Therefore, the lexical accent assigned to morphemes may persist as a representation within the prosodic structure of Russian words. There is no evidence that every syllable bears a tone; instead, the salient difference Halle perceived likely reflects the H+L bitonal pitch accent on stressed syllables. The second high tone and the subsequent fall perceived by researchers on non-stressed morphemes may represent boundary tones between morphological units, particularly those serving an important grammatical function, like derivational suffixes (Figure 2). Phonetic variation also serves as a cue to the internal structure of words in a wide variety of languages [12-13]. Therefore, additional support for our hypothesis lies in the systematic use of a subset of vowels in adjectival suffixes and the properties of vowel reduction in Russian. Suffixes encode gender, number, and case, such that the perception of an internal morphological boundary between the root and suffix may be critical for deciphering word meaning. Russian generally observes two patterns of vowel reduction. The second concerns vowels in all positions other than the pretonic and tonic position. The examples utilize the feminine suffix in nominative case, which comprises two vowels after the initial consonant: unpalatalized /a/ and palatalized /j+a/. During reduction, the initial /a/ is raised /ə/, and we would expect /ja/ to raise to /i/ [15]. However, vowel reduction after palatalized consonants in Russian declensions is not fully realized [15]. This phenomenon reflects the need to preserve critical paradigmatic information that is encoded in Russian derivational suffixes [15]. Therefore, we would anticipate only the first vowel to be raised in the given phonetic environment.

This interpretation provides a justification for the H to L fall in pitch that is perceived in Russian adjectival suffixes when in a non-phrase final position (Figure 3). The high tone, represented by the reduced initial vowel, is followed by a palatalized vowel without full reduction, and therefore is perceptually lower. To investigate this hypothesis, Russian pitch accents and the F1/F2 values for vowels were analyzed in adjectives: the feminine singular nominative ending preceded by (i) /k/ (any – вся́кая, democratic – демократи́ческая), and (ii) /n/ (stupid – глу́пая, smart – у́мная). The sentences were produced by four native speakers of Russian (2 female). The dataset comprised between 40-50 instances of each suffix vowel (/a/,/ja/) per participant. ANOVA and regression analyses was performed to identify if (i) vowel type or (ii) formant values would predict perception of a high or low tone. Position was found to be a significant predictor of the mean vowel pitch.

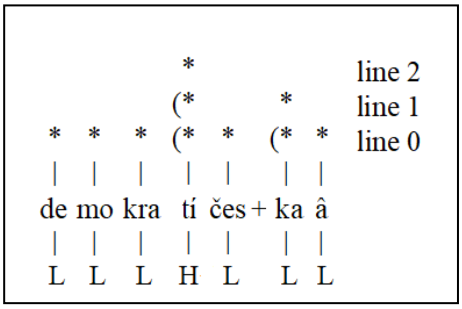

Fig.1 Isardi's Model

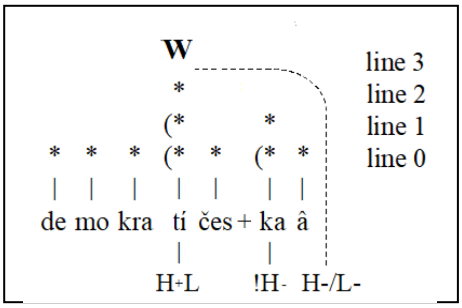

Fig.2 Proposed Model

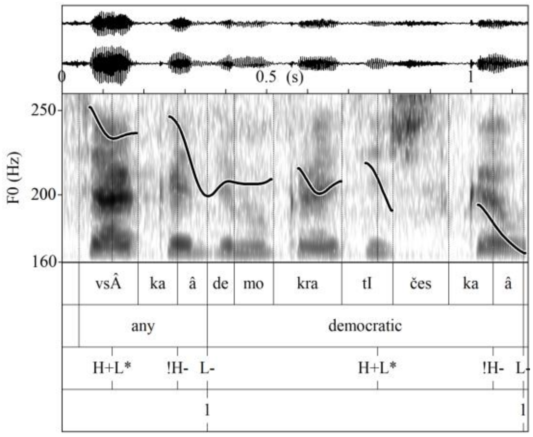

Fig.3 Tones in Russian Adjectives

ANOVA Summary

Effect	df	F	p
position	2, 2	43.453	0.022
f1	1, 0.00	0.978	0.999
f2	1, 0.00	0.408	0.999
position ✻ f1	3, 2	0.068	0.974
position ✻ f2	3, 2	0.025	0.993
f1 ✻ f2	1, 0.00	3.124e-5	1.000
position ✻ f1 ✻ f2	3, 2	2.196e-6	1.000

Note. Model terms tested with Satterthwaite method.
Note. Type III Sum of Squares

Fig.4 Statistical Analysis

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