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Vowel-zero Alternations in Russian Non-derived Words

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One problem facing linguists dealing with Russian morphology is how to treat the vowel-zero (V- \emptyset) alternations found in various case forms of non-derived words and in various partners of derivationally related words. These alternations have been traced to historical sound changes, but due to subsequent sound changes the situation in modern Russian has become fairly complex. Researchers attempting to provide a synchronic account of word-formation have had to resort to abstract underlying representations when dealing with words that exhibit the V- \emptyset alternation. In this paper I briefly review the historical events that resulted in the V- \emptyset alternations. I point out weaknesses in the solutions that have been proposed to account for these alternations and propose a different solution, one which makes use of the synchronic manifestations of the vowels in question.

Words that exhibit identical lexical meaning, which differ only in grammatical endings are normally considered to be grammatical variants of a single word, or more precisely, variants of a single stem. Due to historical sound changes, the form of a stem may differ from one grammatical variant to another. For example in the English word hoof, the voiceless continuant [f] alternates with its voiced counterpart [v] in the plural form hooves. It has been shown that given adequate phonological rules these words can be derived from a single underlying stem. This approach accounts for the identity in meaning shared by the parts of these words not involved in inflection, since both words are derived from a single stem.

In Russian historical sound changes have produced many such alternations within stems. One such sound change that occurred in Russian was the development of lax vowels. Old Russian contained two lax vowels, called jers, a high front vowel and a high back vowel, transcribed here as [i̯] and [u̯]. These two vowels were in complementary distribution: back jers occurred only after nonpalatalized consonants and front jers only after palatalized consonants. In time the jers that were stressed became fully vocalized, i.e. i and u lowered to e and o, respectively. Jers that were before a syllable containing another jer were also vocalized. Most other jers were dropped (Kantor:396-397). These historical events can be schematized:

(1)	Old Russian	sŭnŭ	sŭna	d'ĩn'ĩ	d'ĩn'a
	ŭ, i̯ → o, e	sonŭ	--	d'en'ĩ	--
	u, i̯ → \emptyset	son	sna	d'en'	d'n'a
		'sleep'	'sleep'	'day'	'day'
		Nom/Sg	Gen/Sg	Nom/Sg	Gen/Sg

It can be seen from this example that one phonological alternation in Russian that resulted from the development of the jers is that of a vowel (either o or e) with zero. Only those stems that once had a jer exhibit this alternation: Nom/Sg STOL 'table' - Gen/Sg STOLA. Here o does not alternate with zero; historically it was an o, not a jer.

A subsequent sound change in Russian was the shift of Old Russian e to o when stressed and before a nonpalatalized consonant: OR [m'eda] 'of honey' - Modern Russian [m'oda]. Since this shift occurred after the change of i to e (vocalization of jers) it affected the new e also:

(2)	Old Russian	ǰig	ǰigla	ǰigt'i
	palatalization	--	--	ǰič'
	ǰ, i --> o, e	ǰeg	--	ǰeč'
	ǰ, i --> ∅	--	ǰgla	--
	e --> o	ǰog	--	--
		'he burned'	'she burned'	'to burn'

Due to these sound changes, modern Russian exhibits the following alternations:

(3)	<u>o</u> (derived from ǰ)	-- ∅	as in SON	SNA
	<u>e</u> (derived from i)	-- ∅	as in DEN'	DN'A
	<u>o</u> (derived from i)	-- ∅	as in ŽOG	ŽGLA
	<u>e</u> (derived from i)	-- o	as in ŽOG	ZEČ

These alternations cannot be accounted for in the modern language by means of a simple phonological rule of the type o → ∅ when followed by a vowel, since words with original o do not truncate this vowel. Similarly, the rule e → o before a hard consonant is inadequate because there are other sources for e in Russian which did not undergo this change (cf. SNEG 'snow' from OR SNEG).

In order to account for the vowel-zero and e-o alternations in Russian Worth (1968:110) proposed a 'complex set of morphophonemic entities'. For vowels alternating with ∅, Worth proposed the existence of a morphophoneme which he transcribed as #. Thus, for Worth, d'#n' is the stem for all inflected forms of den'. He proposed other abstract symbols, namely % and Ø, to account for similar alternations in derivationally related words; and he uses the symbol # in derivation as well. Worth sees the underlying stem of okno 'window' as ok#n-. A 'flexional rule' generates phonetic zero from this morphophoneme to produce Nom/Sg okno. Another rule realizes # as o in the genitive plural.

Let us examine more closely Worth's proposed underlying segment # for use in non-derived words, or using Worth's terminology, flexional stems. Worth (1968:114) says, 'the choice of full vowel or zero is determined partially phonetically, partially by paradigm class or stylistically in endings, but is conditioned almost exclusively by phonetic environment in the case of stems.' He then proposes the rules:

(4)	# --> ∅ / ___ C _o V
	# --> vowel / elsewhere, i.e. ___ CC
	___ C#
	___ #C

Since # has traditionally been used in underlying representations for phonetic [∅] (i.e. word boundaries) and since Worth does not

differentiate this symbol from the one he proposes, Worth's novel (and ingenious) use of it to account for the V-∅ alternations in Russian runs into trouble. First, this # differs from word boundary # in that the former can be realized as a phonetic entity, namely a vowel. Word boundary #, on the other hand, never is. Second, Worth's # must be differentiated from word boundary # in some way, otherwise we would get non-occurring forms such as *okono from underlying #ok#n##bylo#, where ##b fits the third part of Worth's vocalization of # rule. Third, Worth's rules do not take into account one of the most striking regularities of the V-∅ alternation in non-derived words, namely that the full vowel (o or e) is always realized under stress. Finally, the use of an abstract symbol violates the naturalness condition of underlying representations, for which Kiparsky (19) has convincingly argued.

Theodore Lightner has proposed another solution to the V-∅ problem. He suggests that the underlying system of Russian contains two lax vowels, namely a lax high back vowel ǔ and a lax high front vowel ǐ. He calls these vowels jers. In order to account for the V-∅ alternation in non-derived forms, Lightner suggests the following ordered rules:

- (5) 1. ǔ,ǐ → ∅ except / __ C₀ ǔ,ǐ
 2. ǔ,ǐ → o,e

Here are some sample derivations.

Underlying	sǔn+ǔ	sǔn+ǎ	okǔn+ǔ	okǔn+ǔ
rule 1)	sún	sna	okno	okún
rule 2)	son	--	--	okon

These rules work only if there exists a universal convention which states that stressed vowels do not truncate: cf. dialectal rǔta 'mouth' which according to Lightner is derived from rǔta; there are many more examples from derived words, cf. rǔtik 'small mouth' derived from rǔtik+ǔ (examples are Lightner's).

Lightner's approach to the V-∅ problem works well, given the universal convention that stressed vowels are never truncated, which he proposes. The approach has several drawbacks, however. First, it requires the presence of the underlying desinences ǔ and ǐ in the Nom/Sg and Gen/Pl of many nouns, where it is just in these cases in Russian that there are no endings. This is necessary to retain and eventually vocalize the jer in the stem. It may be argued that a 'trace' of the ending is found in the vocalized jer--which otherwise would be truncated. Lightner postulates these desinences solely for this reason. The endings themselves are never vocalized; they are always dropped. In short this desinence is really an abstract, albeit historically accurate, symbol whose only function is to allow stem-bound lax vowels to become vocalized according to rule 1 above. Without independent motivation for these desinences, it is hard to accept this proposal.

The second problem with Lightner's approach is that, implicit in his analysis the segment ǔ somehow underlies o and its phonetic manifestations, [ə] and [ʌ]. In fact, o never alternates with [ǔ].

This is further evidence that $\underset{\sim}{u}$ is an abstract symbol, void of any psychological reality, much like Worth's $\#$. There seems to be no valid phonetic evidence to the statement that in Russian some $\underset{\sim}{o}$'s are derived from underlying $\underset{\sim}{u}$.

Finally, while Lightner's analysis recognizes that stress plays an important role in determining which member of the alternation is realized on the surface, it requires an uneven distribution of stress. For example, the word stol 'table' is end-stressed; the final vowel of each form in the paradigm is stressed. In Lightner's approach, the Nom/Sg desinence, however, cannot be stressed or else it would be vocalized to produce the non-occurring *stolo.

The analyses of Worth and Lightner represent the current approaches to the V- \emptyset problem. Lunt (1978:230) states 'analysts nearly always end up positing some sort of underlying unit to take care of the vowel-zero alternation.' He concludes that the loss of jers 'has not yet taken place in Russian' and adopts a position similar to that of Lightner.

I will now present an alternate approach to the V- \emptyset problem. This approach holds strictly to the condition that phonological segments that underly surface forms must occur in the surface forms. Thus, a segment such as $\underset{\sim}{u}$ is not considered a viable possibility for an underlying segment for modern Russian. The segment $\#$ will be considered a word boundary which is never phonetically realized except as a pause in deliberate speech. For ease of reference, here again are the alternations involved:

(6)	$\underset{\sim}{o}$	-	\emptyset	SON	SNA	
	$\underset{\sim}{e}$	-	\emptyset	OKON	OKNO	(see discussion below)
	$\underset{\sim}{e}$	-	\emptyset	DEN'	DN'A	
	$\underset{\sim}{I}$	-	\emptyset	SOSEN	SOSNA	(see discussion below)
	$\underset{\sim}{e}$	-	$\underset{\sim}{o}$	ZEC	ZOG	

Word pairs such as spisok - kiosk show that epenthesis can be ruled out as the source of the alternating vowels. Russian $\underset{\sim}{o}$ is lax and unrounded [ə] and [ʌ] when not stressed: stol [o] - stolá [ʌ], mólod 'young' [o] - molodój 'young' [ə]. Note, however, that this $\underset{\sim}{o}$ differs from the one which alternates with \emptyset . The difference lies in its surface distribution. When $\underset{\sim}{o}$ from historical jer is stressed, two consonants or a consonant and a word boundary follow. When normal $\underset{\sim}{o}$ is stressed, it may occur at word-final position (alternating $\underset{\sim}{o}$ never does), before a consonant followed by a word-final vowel or anywhere else in the word. Alternating $\underset{\sim}{o}$ does not occur in these positions. In short, while both these $\underset{\sim}{o}$'s alternate with reduced vowels [ə] and [ʌ], only one alternates with \emptyset , the one which is restricted in distribution. In order to account for the vowel-zero alternations discussed above, and in order to account for the dichotomy in distribution just discussed, I suggest that there are at least two sources for Russian phonetic [o], namely underlying $\underset{\sim}{o}$ and underlying ə. The latter underlying segment is different from Lightner's $\underset{\sim}{u}$ in two ways. First, it is a segment which occurs in speech, i.e. its use as an underlying segment does not violate the naturalness condition. Second, it occurs in underlying forms only where it occurs on the surface. When no phonological rules alter

it, it is realized as surface [ə]. Its presence is not required to account for other ə's becoming vocalized in non-derived words. A third source of [ə] is underlying I, which is phonetically similar to Lightner's i only I, too, is restricted to environments where it occurs in speech. This segment also alternates with e and o.

We will discuss below how these segments are related by phonological rules. First it is worthwhile to point out the theoretical reasons for suggesting underlying ə and I are the source of the V-∅ alternations. Jakobson (1949:156) discusses the underlying form of the root for the word smotrét' 'to look'. He compares the 1st Sg and 2nd Sg forms which are stressed differently: smotr'ú - smótriš', which he renders phonetically as [smatr'ú] and [smótr'is]. Jakobson takes 'as basic the alternant which appears in a position where the other alternant too would be admissible' and concludes that the underlying form of the stem must be smotr' because given the alternation of the stem vowels o-a, the o occurs under stress. Since a is permitted under stress too, it must be secondary in this stem. While Jakobson's conclusion is certainly correct, it does not follow from his example. The phonetic rendering of the 1st Sg form is [smatr'ú] and [Λ] never occurs under stress. In order to determine which is underlying here, o or Λ, we must return to Bloomfield's statement, as Jakobson (p. 166) does in relation to a question regarding morphology: 'When forms are partially similar, there may be a question as to which one we had better take as the underlying form... The structure of the language may decide this question for us, since taking it one way we get an unduly complicated description, and taking it the other way, a relatively simple one.' Bloomfield's statement can be applied to underlying segments as well as to underlying morphemes. Thus, while [o] and [Λ] both occur in the stem of the verb 'to look' in Russian, it is easy to settle on o as the underlying segment since Λ, when stressed, can be either a or o (cf. mol[Λ]ko 'milk' - mol[o]čnyj 'milky'; sekret[Λ]r'a 'of a secretary' - sekret[ar] 'secretary'. In short, it is impossible to predict phonetically whether in a given word [Λ] represents underlying o or a. Phonetic [Λ] is ambiguous in Russian. For smotrét', o alone can be considered basic. The same reasoning suggests that in the case of the V-∅ alternations, it is impossible to predict which segment of ə underlying o represents: the one which never is realized as zero or the one which sometimes is. In this instance the o is ambiguous. Consequently ə, which alternates with zero must be taken as basic; the ə that does not alternate with zero must be taken as derived. The relationship between ə and o can be described by phonological rules involving stress and consonant distribution. That I, which alternates with zero, underlies both o and e can be established by similar reasoning.

We now proceed to the phonological rules which relate underlying ə to o and ∅ and underlying I to o, e, and ∅.

- (7) 1. ə → o / (+stress)
 2. I → o / (+stress) ___ C'', C'' (-delayed release)
 3. I → e / (+stress)
 4. ə, I → ∅ / ___ CV

Here are some sample derivations. The term 'other' refers to other well-known phonological rules.

Underlying	sən	sən'ta	ʒIg+1	ʒIg+1a'	ʒIg+c'	okən'to'	okən
Other	--	--	ʒIg	--	ʒIc'	--	--
rule 1)	son	--	--	--	--	--	--
rule 2)	--	--	ʒog	--	--	--	--
rule 3)	--	--	--	--	ʒec'	--	--
rule 4)	--	sna	--	ʒgla	--	okno'	--

Underlying	dIn'	dIn'a	sosIn'ta'	sosIn
rule 1)	--	--	--	--
rule 2)	--	--	--	--
rule 3)	den'	--	--	--
rule 4)	--	dn'a	sosna'	--

Phonological rules accounting for akan'e and ikan'e will be ordered after the set of rules proposed above.

This paper has been limited to proposing a solution to the V-∅ alternations in non-derived words. The phonological rules proposed above should also apply to words formed by productive derivational processes, such as knižka 'small book', which they do. More perplexing problems arise, however, when the derivation involves multiple lax vowels such as in the pair búlka 'bun' - búločka 'small bun'. In the latter, the o never alternates with zero. According to what has been presented above, this must represent underlying o. Yet, in the source word for this diminutive, the o does alternate with zero búlka - búlok (Gen/Pl). According to what I have suggested above, this o is underlying ə. Which is it, o or ə? This question has been the subject of much investigation and has helped lead to the kind of abstract formulations already discussed. It seems possible that a minor change in one of the proposed phonological rules would produce the correct results in the majority of cases. This change mirrors the historical sound change involving vocalization of jers before a syllable containing another jer. Rule 4 can be rewritten:
 4. ə, I, -> ∅ / ___ CV (+tense) or (+stress). Thus, in the underlying form bulək+Ik'ta, rule 4 would not delete ə, which is realized phonetically ([buləčkə]). It appears that the approach suggested in this paper for the V-∅ alternations in non-derived words holds promise for accounting for similar processes in derivationally related words.

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