



Phonetic evidence for clitic-host relations within the prepositional group in Russian

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Abstract

The paper presents a corpus-based research on clitic-host relations within the prepositional group in Russian. As a phonetic criterion for determining the relation between clitics and their hosts, we suggest using the degree of vowel reduction—the phenomenon functioning within the prosodic word. A comparison of vowel reduction patterns for clitic group vs prosodic word with no adjacent clitics provides phonetic evidence on the status of clitics in Russian. For our research we have chosen the most numerous class of clitics—prepositions. In addition, we have divided prosodic words with no prepositions into those with and without prefixes. Our study has shown that the vowel reduction pattern is the same for all three groups of prosodic words. This may serve as phonetic evidence for three conclusions: (1) prepositional clitics in Russian form a single prosodic word with the following host; (2) vowel reduction pattern applies across morpheme boundaries within the prosodic word; (3) prepositions and prefixes do not differ in terms of vowel reduction patterns. Additionally, we have found that prepositions have slightly weaker degree of reduction compared with prefixes and non-prefixal word-initial syllables, but this difference is just above the 5 % significance level.

Index Terms: clitic group, prosodic word, prepositions, vowel reduction, Russian

1. Introduction

The current study focuses on the prosodic status of clitics in Russian. The aim of the paper is to answer the question whether clitics in Russian are prosodically independent or they are internal elements of the prosodic word.

There is no canonical definition of the ‘clitic’, as in different languages they have various phonological and morphosyntactical properties. Still many linguistics agree that prosodically it is a ‘little word that does not bear independent accent but rather leans on an adjacent word’ [1].

In Russian, proclitics include prepositions, conjunctions, particles; enclitics include a very limited set of particles [2], [3]. Pronouns may be either clitics or free words.

The most accepted typology of relations between a clitic and its host was suggested by Selkirk [4]:

- free clitic: $(clitic(host)_{PWd})_{PPh}$,
- internal clitic: $((clitic\ host)_{PWd})_{PPh}$,
- affixal clitic: $((clitic(host)_{PWd})_{PWd})_{PPh}$,

where PWd is a prosodic word and PPh is a phonological phrase.

There is a number of phonological tests for determining the type of the clitic-host relation [5].

Vowel harmony in Degema operates both across root-affix boundaries within the word and across host-clitic boundaries, which may be an argument for treating the two as a single prosodic word [6].

Another one is the place of stress within clitic-host group. For instance, stress shifting from host to clitic may serve a criterion to treat both as one prosodic word (see examples for pronominal clitics in Standard Greek [7]). In contrast, no such shifting is a sign of the clitic’s relative independence from the host (see examples for Standard Italian [8]).

For Russian there are several criteria for determining clitic-host-relation.

Stress retraction, i.e. stress shift from the noun onto the preceding preposition, as in ‘по лесу’ /poɫʲisu/ (‘through the forest’), is an argument for considering prepositions as internal clitics in Russian. Meanwhile, stress retraction cannot be a primary argument for considering preposition group in Russian as a single prosodic word, as stress retraction may happen only with a limited set of noun wordforms having stress on the first or the last syllable [3, p. 7]; moreover, these cases are highly variable in contemporary Russian [9].

‘Jer insertion’. Jer vowel in allomorphs of prefixes and prepositions characterized by realization of final ‘o’, e.g. ‘в/во, к/ко, под/подо, с/со’, have different distribution on large-scale text statistics depending on whether it is a prefix or preposition [10]. It is considered as an evidence for that prepositions and prefixes are not identical in Russian [11].

Regressive assimilation of consonants. As shown by Gvozdev [12, p. 135], regressive palatalization is observed both within the root and across the boundary between the preposition and the content word, e.g. ‘с ними’ /sʲ nʲimʲi/ (‘with them’); this is not the case with two content words. However, this criterion is losing its relevance: these observations date back to over 50 years ago, and in contemporary Russian regressive assimilation is observed rarely [13].

Final devoicing. Devoicing of word final voiced consonants occurs both before content words and enclitics, while it does not occur in prepositions before nouns [14]. (This has to be demonstrated by words beginning with a sonorant, since otherwise devoicing or lack of it might be caused by assimilation.) For example, compare devoicing of final /g/ in ‘ног’ before the enclitic ‘ли’ versus no devoicing of final /z/ in the preposition ‘из’ in the phrase ‘из ног ли’ /iz ˈnok li/ (‘out of legs’). It is an argument for differentiating clitic-host relation of proclitics and enclitics in Russian and for that enclitics are free clitics in Russian.

Despite the fact that proclitics typically do not undergo final devoicing, there are still some exceptions. For example, of the two prepositional phrases ‘через лес’ and ‘сквозь лес’

(both meaning “through the woods”), the former preposition is pronounced with the final voiced /z/, while the latter—with the final unvoiced /s/. Other relatively new evidence for final devoicing of prepositions in colloquial speech were provided by Lichtman, e. g. devoicing of final /d/ in the preposition ‘под’ in the phrase ‘под Москвой’ /pat mask’voj/ (‘near Moscow’) or in the preposition ‘перед’ in the phrase ‘перед нами’ /pr’it’nam’i/ (‘in front of us’) [15, p. 54].

Thus, in Russian a number of phenomena seem to support the tendency for treating proclitics as part of phonological phrase together with the content word. We only speak of a tendency, not a rule, since there are several exceptions, including the fact that proclitics often carry secondary stress, and inconsistencies in the behaviour of prepositions with respect to final devoicing (see above the example of ‘через’ and ‘сквозь’). However, if in our analysis we limit our material to those proclitics which are least liable to show such inconsistencies, we will be able to support or reject this hypothesis: if the tendency is strong enough, this is where it should be most prominent. A group of one-syllable prepositions is the best choice for such analysis, since (1) they are often homonymous with prefixes, which means the same sequences of phonemes can occur at the beginning of a content word; (2) they are not likely to carry secondary stress since they contain only one syllable.

As phonetic evidence for clitic-host relations between the preposition and the content word, we suggest using vowel characteristics. In Russian unaccented vowels are reduced within the prosodic word, and the degree of reduction depends on the position of the unstressed vowel relative to the stress and word boundaries. This allows to use *all* the vowels within the prosodic word to determine its boundaries and therefore find out whether a clitic is an internal part of the prosodic word or not. A comparison of vowel reduction patterns for prosodic units—clitic group vs prosodic word with no adjacent clitics—allows to obtain phonetic evidence on the status of clitics in Russian. We believe it is reasonable to divide the latter set into words with and without corresponding affixes, e.g. for proclitics—prefixes. Thus, the prosodic units to be compared are:

- unstressed clitic + content word;
- content word with unstressed affixes and no clitics.
- content word having no affixes or clitics.

2. Material and Method

The corpus used in this study is CORPRES (Corpus of Professionally Read Speech) developed at the Department of Phonetics, St. Petersburg State University [16]. The corpus contains recordings of various texts read by eight speakers; the total duration is over 30 hours; it contains over 200 thousand running words and 1.1 mln sounds. Along with the orthographic transcription and manual prosodic annotation, the corpus contains two phonetic tiers:

- manual transcription produced by expert phoneticians and based on perceptual and acoustic analysis (using spectral data if necessary);
- automatic transcription produced by grapheme-to-phoneme transcriber following the orthoepic rules of Standard Russian including the rules describing the processes observed in connected speech (such as assimilation at word boundaries, lack of stress on clitics etc.).

A difference between manual and orthoepic transcription reflects a significant change in vowel quality which results in

assigning it a phoneme type different from the phoneme type prescribed by orthoepic rules. In our tradition, a phoneme is represented by a limited set of variants, and these sets do not intercept. This means that if a vowel is assigned a different phoneme type, the change in quality is so crucial that *another language unit* (phoneme) is used. Choosing a variant within *the same* phoneme is acceptable in speech, since the language unit is not changed. This is why we only detect those cases which represent phonemic changes.

Given a large corpus of data, the key assumption of our study is that both the probability of vowel change and quantitative vowel reduction are influenced by the same factors, and the effect of this influence is the same. In other words, we assume that the percentage of cases where manual and orthoepic transcriptions differ may be used to estimate a degree of qualitative vowel reduction. It has already been shown [17] that on a large dataset such estimation does reflect the qualitative reduction patterns used in Russian.

There are two types of vowel changes: vowel omissions and vowel replacements. For example, given the pronunciation /apsta’jat’i’stvi/ (‘circumstances’) instead of /apsta’jat’i’stva/, we observe an omission of /i/ between /t’/ and /l’/ and a replacement of absolute-final /a/ by the phoneme /i/.

In order to calculate the number of vowel changes in different positions relative to the stressed syllables, the corpus data were analyzed automatically using a modified version of Levenshtein algorithm [18].

Each vowel is described considering the following parameters:

- ‘1’ or ‘0’ depending on whether the manual and orthoepic transcriptions for the vowel differ or not;
- position of the vowel within the word: ‘1’ for the 1-st pre-stressed syllable, ‘2’ for the 2-nd pre-stressed syllable, ‘3’ for the 3-rd pre-stressed syllable.
- for unstressed vowels: the length of the pre-stressed part of the word where the vowel occurs.

The percentage of omissions and replacements (sound change rate) was calculated for each position within the word. Vowel omissions were included in this estimate since we consider them as extreme cases of vowel replacement.

The values for unstressed vowels were grouped according to the length (the number of syllables) of the pre-stressed part of the word where it occurs. Compound words containing more than one stressed syllable were excluded from the analysis. We assume that the length of the post-stressed part of the word has no crucial influence on the vowel reduction processes within the pre-stressed part, see the study on the vowel reduction [17]. Thus, for example, the words ‘кора’ /ka’ra/ (‘bark’), ‘палата’ /pa’lata/ (‘chamber’) and ‘количество’ /ka’lit’istva/ (‘quantity’) can be grouped together to analyse the vowel reduction processes in one-syllable pre-stressed groups, despite the fact that they have a different number of post-stressed syllables.

Then for each part N vowel positions were analyzed, where N is the length of the pre-stressed part of the word. Since vowels occurring at word boundaries are less reduced in Russian [19], vowels in initial syllables were subdivided into two groups: absolute initial vowels and vowels preceded by one or more consonants, respectively.

We have chosen vowel /a/ as the object for vowel reduction analysis as it has two degrees of reduction in Russian, whereas other vowels have one degree of reduction [19] [20] and it is the most frequent vowel in Russian speech [21].

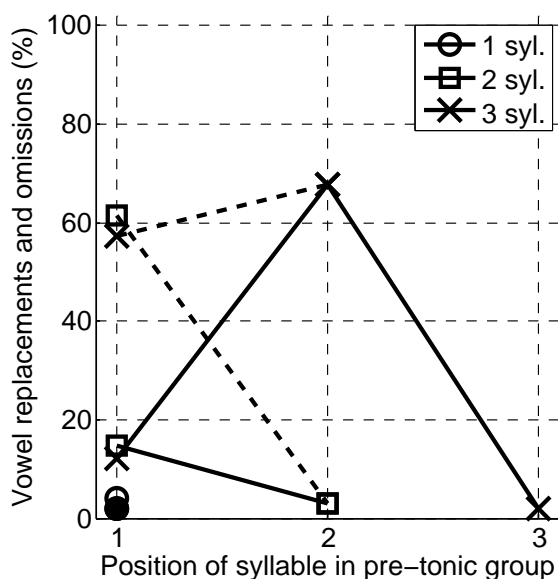


Figure 1: Sound change rate of /a/. Monosyllabic preposition and content word.

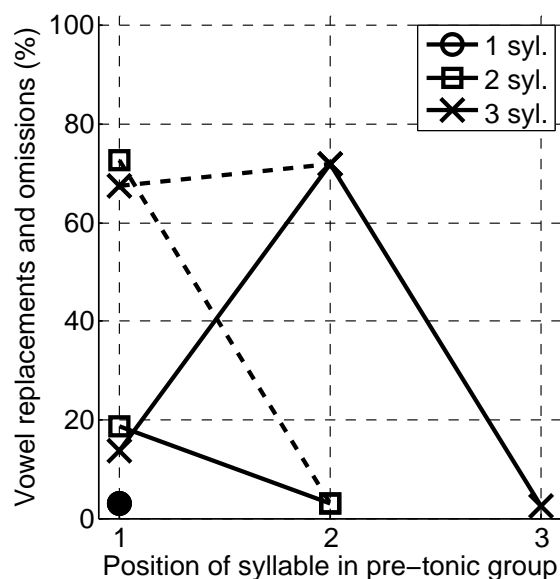


Figure 2: Sound change rate of /a/. A content word with monosyllabic prefix.

The given corpus contains about 8000 unstressed prepositions with vowel /a/ and less than 300 of other clitics with vowel /a/. The latter set is not only small but also heterogeneous. This is why we limit our experimental material to the prepositions as clitics—and therefore prefixes as affixes.

The corpus contains:

- 8000 prepositional phrases. A set of monosyllabic prepositions with unstressed /a/ found in the corpus includes: во, для, до, за, ко, на, над, о, об, от, по, под, про, со.
- 15000 words with monosyllabic prefixes in the corpus. A set of required monosyllabic prefixes with unstressed /a/ found in the corpus contains: во-, воз-, вос-, до-, за-, на-, над-, об-, от-, по-, под-, про-, со-, раз-, рас-.
- 33000 lexical words having no prefix and starting with initial syllable with /a/ vowel.

The first two sets are almost equal excluding just a few prefixes and prepositions. A considerably high amount of analysed data and highly intersected sets of prepositions and prefixes allow to obtain reliable results.

3. Results and Discussion

Figures 1–3 show the percentage of vowel omissions or replacements plotted against the position of vowel within the word (where N on the horizontal axis denotes the N-th syllable) for 3 types of pre-stressed groups based on their length (in syllables): 1-syllable group (circle markers), 2-syllable group (square markers), and 3-syllable group (cross markers). For initial syllables two values are given: for vowels preceded by a consonant (dashed lines; for 1-syllable pre-stressed groups—unfilled circle: e. g. ‘коpa’ /ka’ra/ (‘bark’)) and for absolute-initial vowels (solid lines; for 1-syllable pre-stressed groups—filled circle: e. g. ‘ора́ть’ /a’rať/ (‘to scream’)).

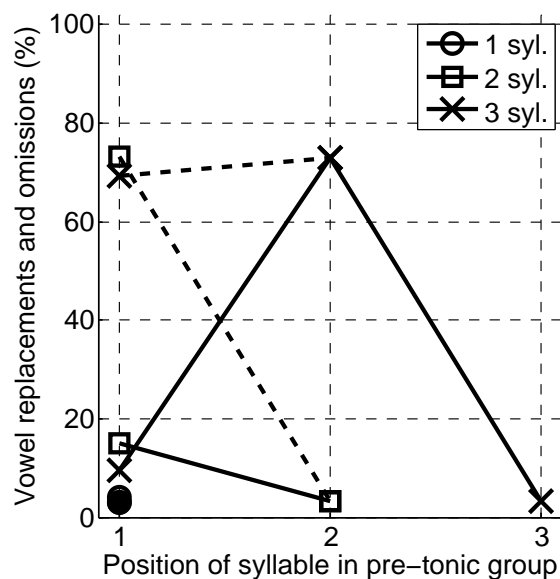


Figure 3: Sound change rate of /a/. Content word with no preposition or prefix.

Fig. 1 shows the case of prepositional group with monosyllabic prefix, Fig. 2 shows a case of single content word with monosyllabic prefix, and Fig. 3 shows a case of single content word with no prefix.

According to repeated measures ANOVA, the effect of clitic (preposition vs. prefix vs. no preposition or prefix) on sound change rate is just below the 5% significance level ($F(2, 16) = 3.74, p = 0.046$). Pairwise comparisons (two-tailed paired Welch’s t-tests) show that words with a prefix do not differ from those without a prefix or preposition (Fig. 2 vs. Fig. 3):

$p = 0.512$. However, for words with a preposition, p -values are slightly above the 5 % level: $p = 0.065$ for both remaining pairs (Fig. 1 vs. Fig. 3; Fig. 1 vs. Fig. 2).

On the one hand, according to pairwise t -tests, /a/-vowel reduction pattern has no significant difference among these three cases. There are two clear degrees of vowel reduction in pre-stressed groups. The first (lower) degree is observed in two positions: the 1-st pre-stressed syllable and absolute-initial position with no consonants before vowel. The sound change rate for this reduction degree is below 20 %. The second (stronger) degree is observed for all other cases. The sound change rate for the second degree of reduction is above 50–60 %. There is a huge gap between two groups of values. Thus, in general, vowel reduction pattern is the same for all three groups of prosodic words: with preposition, with prefix and with neither of them.

On the other hand, for words with prepositions the closeness of p -values to the 5 % level shows that this group might still be different from the other two. As seen from the figures 1–3, these groups differ mostly in the values for the first syllable, i.e. the preposition itself. Thus, we might speak of a slight tendency for prepositions to have slightly weaker qualitative reduction.

The latter is in accordance with the results proposed by Vassilieva and Tananaiko in [22]. They analyzed the reduction of vowel /a/ in the second pre-stressed syllable in prefixes, prepositions and roots for several hundred prosodic words. They demonstrated the difference between these groups; the qualitative reduction was weaker in prepositions than in other groups. However, we believe that the size of the corpus used in the present study yields more convincing results.

Therefore, in terms of formant characteristics, prepositions may show some independence from the content word. But when it comes to phonemic alternations, where a change in vowel quality is so strong that the vowel is perceived as pertaining to another language unit (phoneme), the difference between a preposition and a prefix seems to be wearing off.

Our data allowed us to carry out an even more strict experiment: a comparison of a preposition and a prefix with identical segmental content. In the given corpus, both preposition ‘по’ and prefix ‘по-’ are the most frequent among prepositions and prefixes respectively. Thus we eliminated the influence of segmental context, such as number and type of consonants in the preposition, and differences in the frequency distributions among various prefixes and prepositions. We have analyzed 1068 prepositional phrases with the preposition ‘по’, 3876 words with the prefix ‘по-’ and 3324 words beginning with the syllable ‘по-’ and having no prefixes. The data on sound change rate for this dataset confirmed the results described above for all monosyllabic prepositions and prefixes.

This may serve as phonetic evidence for the tendency that prepositional clitics in Russian are related to the following host as internal clitics forming a single prosodic word. When comparing prepositional clitics in Russian with those in other Slavic languages, they show similar behavior with published results on Polish and some dialects of Serbian, although other criteria were used for determining the status of clitics. Final devoicing was considered by Booij and Rubach for Polish [23]. Their data on absence of final obstruent devoicing in prepositions before a noun, e. g. ‘bez namysłu’ (‘without thinking’), was interpreted by Anderson as evidence for affixal status of proclitical prepositions in Polish [1]. Based on the analysis of the realization of tonal word accent in Serbian, Selkirk found all three types of clitic-host relations in different dialects [4].

In addition the experimental results have shown that prepositions and prefixes do not differ in terms of rhythmical or-

ganization of prosodic word, and vowel reduction pattern applies across morpheme and lexical boundaries within a prosodic word. Kalenchuk and Kasatkina proved that recently the boundary between prefix and root tends to disappear on the segmental level [13]. Despite the relative lexical and grammatical independence of prefixes, they are realized phonetically as part of one prosodic word together with the root. Our results have shown that in terms of vowel reduction this is also true for prepositions.

4. Acknowledgements

This research was financed by a research grant 14-18-01352 “Automatic segmentation of speech signal into suprasegmental speech units” provided by Russian Science Foundation.

5. References

- [1] S. R. Anderson, “Clitics,” in *The Blackwell Companion to Phonology*, M. van Oostendorp, C. J. Ewen, E. Hume, and K. Rice, Eds. Blackwell Publishing, 2011.
- [2] A. A. Zaliznyak, *The Tale of Igor’s campaign: linguistic point of view [Slovo o polku Igoreve: vzglad lingvista]*, 2004.
- [3] ———, *Old Russian enclitics [Drevnerusskie enklitiki]*, 2008.
- [4] E. Selkirk, “The prosodic structure of function words,” in *Signal to syntax: Bootstrapping from speech to grammar in early acquisition*, J. Morgan and K. Demuth, Eds. Lawrence Erlbaum, 1996, pp. 187–213.
- [5] A. M. Zwicky, “Clitics and particles,” *Language*, vol. 61, no. 2, pp. 283–305, 1985.
- [6] E. E. Kari, “Vowel harmony in Degema, Nigeria,” *African Study Monographs*, vol. 28, no. 2, pp. 87–97, 2007.
- [7] A. Revithiadou, “A cross-dialectal study of cliticization in Greek,” *Lingua*, vol. 118, pp. 1393–1415, 2008.
- [8] S. Peperkamp, *Prosodic words*. HIL, 1997.
- [9] N. Ukiah, “Stress retraction in phrases of the type ná den, zá sorok, né byl in Modern Russian,” *Russian Linguistics*, vol. 22, no. 3, pp. 287–319, 1998.
- [10] O. Steriopolu, “Jer vowels in Russian prepositions,” *Formal Approaches to Slavic Linguistics*, pp. 368–385, 2007.
- [11] V. Gribanova, “Phonological evidence for a distinction between Russian prepositions and prefixes,” in *Studies in Formal Slavic Phonology, Morphology, Syntax, Semantics and Information Structure: Proceedings of FDSL 7*, 2009, pp. 383–396.
- [12] A. N. Gvozdev, *Selected works on orthography and phonetics [Izbrannye raboty po orfografii i fonetike]*. Academy of Pedagogical Sciences USSR, 1963.
- [13] M. L. Kalenchuk and R. F. Kasatkina, “Features of the phonetic shape of Russian prefixes,” *Russian Linguistics*, vol. 23, no. 1, pp. 1–9, 1999.
- [14] J. Padgett, “On the origins of the prosodic word in Russian,” in *Proceedings of Speech Prosody 2014*, 2014.
- [15] R. I. Lihtman, “Final voiced consonants at word boundaries [Koneqnye zvonkie soglasnye na styke slov],” *Filologičeskie nauki*, no. 1, pp. 52–58, 1980.
- [16] P. A. Skrelin, N. B. Volskaya, D. Kocharov, K. Evgrafova, O. Glotova, and V. Evdokimova, “A fully annotated corpus of Russian speech,” in *Proceedings of the Seventh conference on International Language Resources and Evaluation (LREC’10)*. European Language Resources Association (ELRA), 2010, pp. 109 – 112.
- [17] D. Kocharov, T. Kachkovskaia, and P. Skrelin, “Position-dependent vowel reduction in Russian,” in *Proceedings of the 18th International Congress of Phonetic Sciences ICPhS 2015*, 2015.

- [18] D. Kocharov, "Phoneme alignment using the information on phonological processes in continuous speech," in *Proceedings of the 10th International Conference on Language Resources and Evaluation (LREC'16)*, 2016.
- [19] R. I. Avanesov, *Russian Standard Pronunciation [Russkoe literaturnoe proiznoshenije]*. Prosveschenije, 1984.
- [20] L. Bondarko, *Phonetics of Contemporary Russian [Fonetika sovremennogo ruskogo jazyka]*. SPbSU, 1998.
- [21] O. Bolotova, "On some phonetic features of spontaneous speech and reading in Russian," in *Proceedings of ICPHS 2003*, 2003, pp. 913–916.
- [22] L. A. Vassilieva and S. O. Tananaiko, "Morphological approach for determining the degree of unstressed vowel reduction in Standard Russian [Morphologicheskij podhod k opredeleniju stepeni reduktsii bezudarnyh glasnyh v russkoj proiznositelnoj norme]," in *Proceedings of the 3rd Workshop on Analysis of Russian colloquial speech*, 2009, pp. 47–51.
- [23] G. Booij and J. Rubach, "Postcyclic versus postlexical rules in lexical phonology," *Linguistic Inquiry*, vol. 18, no. 1, pp. 1–44, 1987.